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The Champney Die-Sinking Process.

BY JOHN RANDOL.

In going from one shop to another, and examining new things day after day, I am constantly impressed with the fact that the human mind is very slow indeed to accept new ideas, new methods, or new results. First we refuse to believe the new thing exists, and boldly pronounce it an impossibility; next we say that it is not good and can never come into general use; then we admit that the new thing or method may have some virtues, and may do in some special cases, but we vigorously deny the possibility of its general application; finally, and commonly about 20 years after the first pronounced and undeniable success of the new thing, we make up our minds that there is possibly something in it. Enterprising journalists write it up; some very lively and venturesome engineer is rash enough to read a paper about it before some body of wise men, and last of all capital becomes interested, and the money which would have made the thing a brilliant world-wide success a score of years before, could it have been had, is eagerly offered to assist the inventor of the new thing, who has commonly grown old before the value of his work is recognized even by those whom it most directly benefits. We are all so very wise, those of us who have passed a lifetime in the shops, we know so many good things and good, old-fashioned, long established, reliable, sound ways of doing things, that we all regard it as in the nature of an insult to our own personal understandings when some crazy inventor comes along with his new-fangled jimcrack ideas which make our old established practice look ridiculous; we instantly say to him in effect, no matter how we choose our words, "See here, we have been in this line thirty or forty or fifty years," as the case may be—the longer the time the less our knowledge, generally—"giving all of our thoughts to this line of work. Do you suppose we are stupid enough to have missed anything which has the advantages you are talking about?" So we pass the man with the new idea along down the whole line of our conservative, highly respected and thoroughly established concerns and men in our particular field, and finally the man with the new idea goes into business himself, with little money commonly, and as he scrubs along with his new idea and hard work, we look very wise and say, "I told you so" to him every time we have the opportunity.

We all know what die sinking is, and what it costs; we are all familiar with the clean light shop, with its planers and shapers and drilling machines and its row of die-sinking machines—all beautiful tools; and its row of clean, bright, intelligent workmen sitting at a north light, industriously and with concentrated attention slowly sinking the shape of some piece of work down into the solid metal of a steel block, with their queer shaped files and delicate chisels; most of us have looked at a finished job of die sinking—an absolutely perfect fit for the irregular surfaces of the piece which it is to make, and have secretly wondered at the skill of the workmen who could do such a job. Some of us have seen a marvelously constructed pantagraph tracing its thousands of cuts in a coin die, guided by a large model which its mechanism reproduces in reversed miniature in the block of steel to be used in the coining press, and have also admired and wondered at this beautifully exact piece of high-grade mechanism, and of course we know a lot about die sinking; we know what class of machines must be used, what class of workmen—really artists the good die sinkers must be—what grades of steel, and above all what days and weeks of patient labor must be used to make a finished die. We know it to-day, just as we knew it twenty years ago; die sinking by the old established methods can be seen in almost every good establishment in the metal manufacturing way; the use of the drop hammer and the power press, mechanical or hydraulic, in metal manufactures, is universal, and thousands of dies are to-day being made by the old, slow, skillful, well established methods; and yet George F. Champney, engineer, found out twenty years ago how he could make any die for any purpose, from the heaviest forging die to be used under the most ponderous drop, to the finest medallion or coining die, in one instant—in the very briefest fraction of a second, with the simple, almost rude tools shown in these engravings; and not only found out how to sink dies perfect in shape and surface, but far superior in quality and endurance to any dies ever made by any other method.

Fig. 2.

Fig. 5.

A year ago, a gentleman knowing that I am as one of the Athenians, who hold that day in which they learn no new thing as lost, said to me: "There is a man in Bridgeport who has a hammer with 50 feet drop; he makes a cast-iron force any shape he wants, and fastens it on the bottom of this 50-foot fall hammer, and he puts a block of hot steel on the anvil of that hammer, and just drops the hammer with the force on the bottom of it right down into the steel at one spat, and it makes a perfect die in the steel and don't hurt the cast-iron force at all—doesn't even mark it—you could not tell by the looks of the cast-iron force that it had ever been near a piece of steel, much less been driven bodily into the solid metal, so as to produce its exact and perfect reverse in the block, and make a perfect die in which to reproduce its own shape."

I said to this gentleman that it did not seem possible such things could be; that I should think the cast iron image or force would be crushed to atoms, and that the hot steel block on the anvil would spread out, so that the result of the 50-foot drop of the hammer would be a couple of ruins—a ruined force and a ruined die block, instead of an instantaneously made, absolutely perfect die, and an uninjured force.

To this my informant replied that he himself would have thought the same thing, but that what did result was a perfect die, exactly reproducing in reverse every detail of the piece put on the bottom of the hammer.

In Bridgeport recently I asked at E. P. Bullard's machine tool works, if there was a man in Bridgeport who was making drop dies by dropping a big hammer 50 feet, with the force on the bottom of the hammer, into a block of hot steel, and making a perfect die at one blow. This question was met with a smile, and the reply, "Not that we ever heard of." I said, "You would be likely to know if such a thing were being done?"

"Very likely *indeed*," was the reply. A search in the directory disclosed the name of "The Patent Steel Die Company," 88 Cannon street, and at 88 Cannon street I found Mr. Champney, and the drop hammer with a drop of 52 feet, and a lot of die sinkers, and a vast number of the most beautiful specimens of dies conceivable, an order book full of orders from such firms as the Gorham Company, and I asked Mr. Champney to permit me to take photographs, and write an article for the AMERICAN MACHINIST, descriptive of his incredible achievements, and the results are given herewith, in so far as Mr. Champney would permit.

Twenty years ago the idea occurred to Mr. Champney that at a suitable velocity a cast-iron medal, or even a gold or silver coin, could be driven bodily into a block of hot steel, so as to produce a perfect die in which its own shape could be duplicated by use of the coining press. Experiments convinced him of the truth of his theory. He went to

Fig. 1.

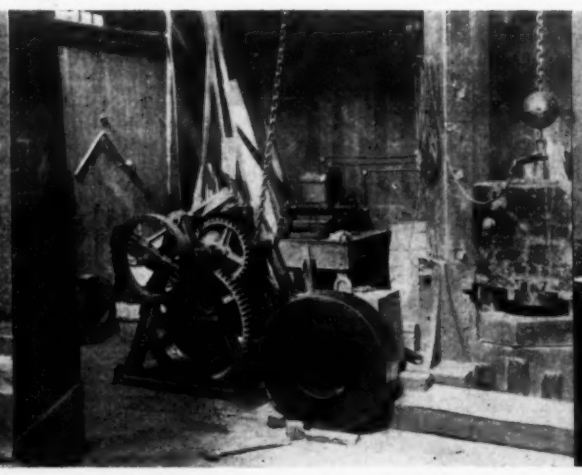


Fig. 3.

Fig. 4.

THE CHAMPNEY DIE-SINKING PROCESS.

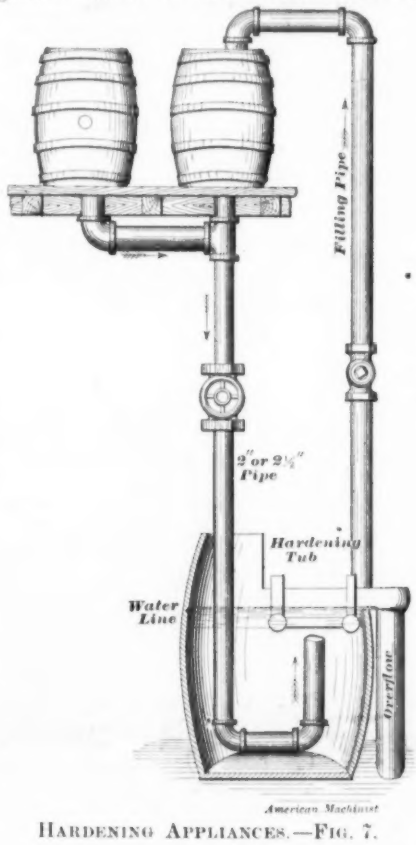
Europe with this invention, and remained abroad for some ten or twelve years, in close connection, for a part of the time, with the Russian Mint, where he made dies which gave from 30 to 70,000 impressions, as against 6,200 impressions for the life of any dies there made by ordinary methods for the same piece, and was decorated by the Emperor with the order of Stanislaus for his invention. After these years in Europe, Mr. Champney returned to America, and proceeded to perfect his methods so as to make them applicable to dies of all sizes; his previous work had been for coining purposes and medals only. He started to work in Bridgeport, where he now makes many dies for leading firms of silversmiths and metal workers all over the United States.

His original idea was simplicity itself—given the model for a piece of work to be produced in dies, the simplest method possible is, of course, to drive that model into a block of steel, so as to leave its perfect impression in the soft die block; then take the model out of the die and harden the die, and there it is. As is usual, between the happy thought and its happy realization, lay a waste of dreary desert years, the story of which Mr. Champney will not have printed. The old story, no doubt, of shining moments of success, buried in speedily following failures; partial gains which could not be made entire and complete, and total disasters which could not conquer Champney's faith in his theories; finally, to-day in Bridgeport there is a small establishment doing good work, patronized by the best manufacturing concerns in the country, and possibly the nucleus of a large and prosperous business for the closing years of Mr. Champney's life.

The method practiced at the Bridgeport shops in producing a hardened steel die to model is this: The model, a bit of wax shaped to the designer's fancy, and mounted on a block of wood, a medal, a coin, a plaster cast of any object, a natural leaf from a tree, anything in short from which a plaster cast can be taken, can have a die made from it which is not an approximate reversed copy, but is absolutely perfect in its reproductions; every line, every elevation, and every depression of the model are made in thousands of duplications from the dies, which are mechanically copied from the models by Champney's processes.

First, if the article is not suitable for use as a pattern to be molded in sand, a plaster cast is taken from it, and in this plaster cast, as a mold, a second plaster cast is made, which is a duplicate in form of the article to be reproduced. Next, this last cast is molded in fine Troy foundry sand, same as any piece of fine iron casting. This sand mold is faced by smoking and printing the pattern back in the mold until the surface of finely divided carbon facing deposited by the smoking process gives an absolutely perfect mold of the model. Then this mold is poured with Barnum & Richardson's carwheel iron—just a good strong foundry iron, nothing secret or special about it. Mr. Champney makes the molds himself, and he also pours them, melting his iron in plumbago crucibles, and with a coke fire in the furnace shown in Fig. 1. New crucibles are to be seen standing on top of the brickwork of the furnace, and one which has been used stands on the floor by its side. The furnace is a plain, iron-banded, brickwork affair, with an ordinary grate of square bars, loose fire-brick doors, and an ash pit, all of the most common construction. At the beginning of this work Mr. Champney was neither a die sinker, nor an iron molder, nor a steel temperer. Now he is all three, and his iron molding comes very near perfection. He showed me a cast in gray iron of a large medallion which was absolutely perfect, and appeared to have been carefully and beautifully finished all over, but had really never been touched since leaving the sand; another, a "waster" not good enough for Mr. Champney's requirements, he gave to me, and it is reproduced in Fig. 2. I coveted the perfect one, but Mr. Champney would not part with it. A steel die had been made from it, but it did not bear anywhere the smallest mark of service. The quality of Champney's *good* iron founding may be guessed from the appearance of the surface of Fig. 2, photographed from the "waster" mentioned. The force, or cast-iron reproduction of the model, is made with an added base, about $\frac{1}{16}$ of an inch thick, as shown in Fig. 2, which is full size; this base is faced on the bottom so as to lie flat and firm up against the bottom of the hammer where it is secured, by means not shown, while the hammer is lifted and falls to make the impression in the die, or is "driven," as the word goes at the Bridgeport Patent Steel Die Company's shops.

The block of steel into which the model is to be driven is not hollowed or shaped out in any way so as to partially conform to the general outline of the "force." On the



HARDENING APPLIANCES.—FIG. 7.

contrary, the face of the die block is roughly crowned both ways, in the shaper, so as to have a clean metal surface, without scale or cinder; the crowning varies with the size of the block; it is quite high, perhaps $\frac{1}{8}$ inch in a block about 6 inches long by $3\frac{1}{2}$ inches wide. The dies are made about the common practice for thickness. After the force or model has been "driven" into the hot steel die the metal of the die is raised up in a high border all round the base of the force, just as it would be if the force had been dropped into a mass of very wet clay, and this raised edge lies up tight against the edge of the base of the "force." The extreme lift of the hammer, 52 feet, is used only for the largest work; various drops of the hammer are used, according to the size of the die. The largest die made by Mr. Champney of which he could find a record, measured 12 inches by 10 inches for the top opening of the die, and was 8 inches deep from the finished surface of the die to the bottom, and the finished die weighed 212 pounds

The hammer used by Mr. Champney weighs 1,500 pounds, and has an extension which can be keyed to its top, which weighs 1,000 pounds, thus making the greatest hammer weight available 2,500 pounds. With 50 feet free drop the final velocity of the hammer would be considerably over 50 feet per second. This is reduced somewhat by the V-uprights which guide the hammer in its fall, so that the extreme velocity attainable is estimated at 50 feet per second. The hammer is lifted by a power-driven winch shown in Fig. 3, a portion of the hammer itself being also shown. The dimensions of the hammer room did not permit placing the camera so as to take a single picture including all of both. The lifting chain is latched to the top of the hammer, and is released by the hand line, seen coiled on the left upright of the hammer guides. These uprights are of wood having cast-iron V-guides bolted to their inner faces. The bottom of the hammer has the usual dovetail and key for holding dies.

It is, of course, essential that the die block should be perfectly confined sidewise. How this confinement is effected I do not know. Mr. Champney did not wish his method to be published, and I preferred not to take away personal information to be withheld from print, so that farther than Mr. Champney's statement that confining the various sizes and shapes of blocks sidewise had troubled him, but that he now had found an easily managed and satisfactory method, and the extremely suggestive massive steel ring seen at the left of the hammer in the engravings, and the other heavy ring lying on top of the anvil, I have no idea of how the heated die blocks are confined while the die is driven.

The steel used is "die steel" made by Farist, in Bridgeport. Any suitable steel may be used, as there is nothing special about the steel.

Mr. Champney said the die blocks were heated to "white" heat before being placed on the anvil for a "drive." The actual degrees of heat could not be given. The heating is done in the furnace shown, as is also the heating for tempering. I did not see a die "driven."

After the driven block is cold it is planed in an ordinary shaper (the only machine tool in the place), and planed flat on top down to the proper hight, and is then passed to the die sinkers, Fig. 4, who do what is needed in the way of finishing and "matting" to the working surfaces of the die. If the force is absolutely perfect then the die need not be touched by the die sinkers, and is not.

Fig. 5, head of Rubens, from celluloid impression from a Champney die, the surface of which was never touched by a hand tool, is of an absolutely perfect finish, as were a medallion head of Ariadne in copper, and a smaller medallion, also in copper, presented to me by Mr. Champney. Both the head of Rubens, which was "driven" from a casting made from a plaster cast of a Brussels medallion, and the copper medals mentioned are of the most perfect surface conceivable, and all were struck in dies which had never been touched by a hand tool. But very many dies are made in the Bridgeport shops from models in wax, which are by no means perfect in detail; the petals of the flowers represented may want sharpening at the edges, matted surfaces are left plain, and delicate lines are omitted entirely, to be put in by hand after the die is driven. As might be guessed, the very smallest and faintest marks on the original are reproduced with absolute fidelity in the Champney dies, and a die struck from a $5 gold piece, with "Champney" in sunk letters, was absolutely faultless in every detail under the microscope, and the die of the "Head of Rubens" has a perfect polish in every detail.

The heating of the dies, and the "driving" under the hammer, and the hardening and tempering are all done by Mr. Champney himself. The heating for all purposes is done in the natural draught Lehigh coal furnace shown in Fig. 1, just as it appeared after a large die had been taken from it to go to the hardening tub shown in Fig. 7. This tub is simply a barrel cut down to take the ends of a die holding grating at the sides, and notched still lower at the right for an overflow.

Two barrels on an overhead platform are filled with water from the small vertical supply pipe, and a much larger stream is piped from these barrels down to the hardening tub (cut down from a large barrel) below. This large pipe has an upward bent open end in the tub, something like 2 inches or 3 inches below a grating made of small wires crossing two bent round rods hooked over the sides of the barrel, all as shown in Fig. 7. The supply stream is small, and the barrels overhead are simply reservoirs.

Pure water only is used. The round wire rods are perhaps an inch or two below the water line established by the overflow at the right. The flow in the large delivery pipe is regulated by the hand valve.

In heating the die the face is not allowed to come in direct contact with the fire; bent pieces of sheet-iron are wired on the die, so as to cover the sides, and an iron tray considerably larger than the face of the die is provided and filled with powdered charcoal or bone charcoal, as may be thought best; this tray is put in the fire, and then the die, having its sides and edges clothed with sheet-iron as described, is laid face down on the tray of charcoal; coal is added around the die, and the furnace door is closed until the die is hot; then the die and tray are taken out, turned right side up, and the tray is then, and not until then, removed from the face of the die, thus keeping the die at all times full of the red hot charcoal or bone dust. Then the die is put bottom down on the grating in the hardening tub; the stream is then turned on against the bottom of the die until it is cooled about half way up, the hot charcoal still filling the cavity of the die, and perfectly protecting it from the air; the die is turned face down on the grating and the full stream of water turned on so as to rush up into the inside of the die and cool it as quickly as possible; the die is returned to the furnace and drawn rapidly after hardening; both heating and cooling are done as rapidly as possible. In illustration of the value of a large stream of water delivered close to the face of the die, Mr. Champney said that a die was brought to him from the Russell & Erwin Factory, New Britain, for a half of a metal door knob an expensive piece of die sinking, which they had tried three times to harden, and believed would not harden at all; this die Mr. Champney hardened, so that no file in his place would touch it, at the first attempt, by the methods described. The Russell & Erwin shops have a tempering tub piped with an up-stream, but the nozzle is 18 inches or so below the grate on which the die is laid, and hence the up-stream is too much diffused, in Mr. Champney's opinion, to be effective.

The exactness of size of dies made by the Bridgeport shops is wonderful. One die, made for exhibition from half of a common ball pene machinists' hammer cut in two in the middle lengthwise, was as perfect a fit everywhere as can be imagined. But Mr. Champney informed me he could make a die considerably larger or smaller than the force, and could also make the die dish or crown more than the model; thus he said he could make the die driven from a $5 gold piece $\frac{1}{32}$ or so larger or smaller in diameter than the model which drove the die, and could also raise or lower the center of the die at will, so as to increase or diminish the weight of the coin struck in the die. He did not explain the means by which he could do this, but said the result was certain and as he wished, invariably, and he added that he had never yet lost or cracked a die in hardening.

Cotton States and International Exposition.

Since the last notes were written several machines have been added to the power plant in Machinery Building. These are a 100 horse-power Weston engine, which is to drive a 1,000-light Thomson-Houston dynamo, also new. These machines have been placed in the incandescent block. In the arc and power block a new power machine has been added. This is a 200 kilowatt generator, and was furnished by the General Electric Co. It is driven by the 300 horse-power cross-compound Buckeye engine, which was named in the last letter as driving a 200 horse Jenney power generator. Both these generators are connected to the engine through a countershaft, and can be run singly or together, each one on partial load and on different circuits.

The boiler-house equipment has been increased by two 500 horse heaters, one from the Excelsior Heater Co., of Chicago, and the other, a Wainwright, from the Taunton Locomotive Works, of Taunton, Mass.

The general machinery exhibits have been pouring into the Machinery Building very rapidly during the last two weeks. Most

exhibitors have had their representatives on the ground waiting for the goods. Hence in most cases the shipments have been unpacked and placed immediately upon arrival.

Much has been written and said about Clara Mere, the beautiful artificial lake, which has been formed in the middle of the exposition grounds. Owing to some difficulties being encountered during the construction of the conduit which admits the water into the well for the six Worthington fountain pumps, it was found necessary to shut off the stream of water which was filling Clara Mere. It was necessary to keep this pipe closed for several days. Some local daily newspaper reporter got wind of it and started the question rolling, "Will Clara Mere be filled in time?" It rolled and rolled and grew to be as much of a bugbear as the other stock question, "Will you be ready for the opening?" But Clara Mere is full and has been so for several days, so full in fact that the water in the pump well stands several feet above the foot valves on the pump suctions.

A number of the electric launches have arrived and several trial trips have been made with them. They add much to the beauty of the little lake.

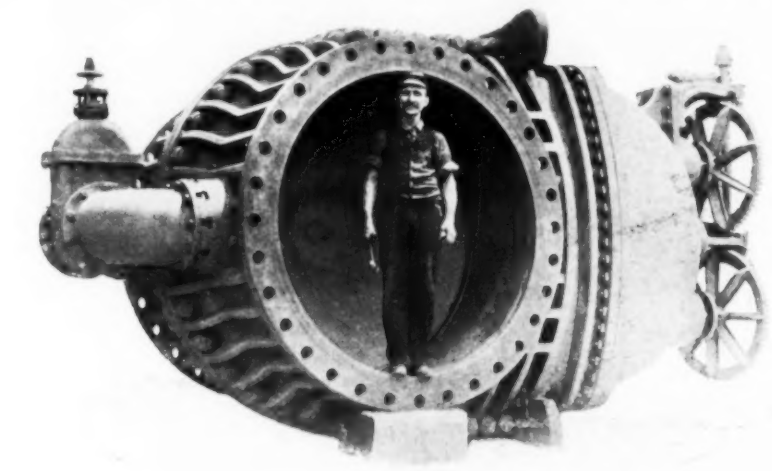
A great deal has been written about the electric fountain at the Atlanta Exposition. Its designers promise that it will excel the wonderful pair which formed so strong an attraction at the World's Fair. There are to be two spray fountains which have been scarcely mentioned as yet. These fountains will have no coloring effects. The sprays are located one on each side, or rather each end of the electric fountain, each being about 200 feet from it. Water at 60 pounds pressure per square inch will be furnished these fountains from a 2½ million gallon pump, of the John H. McGowan Company's manufacture. This pump is located in the McGowan Company's exhibit, which is very near the Henry R. Worthington space. The exhibits of both these concerns are very large, containing as they do many different machines of many designs, and nearly all in operation.

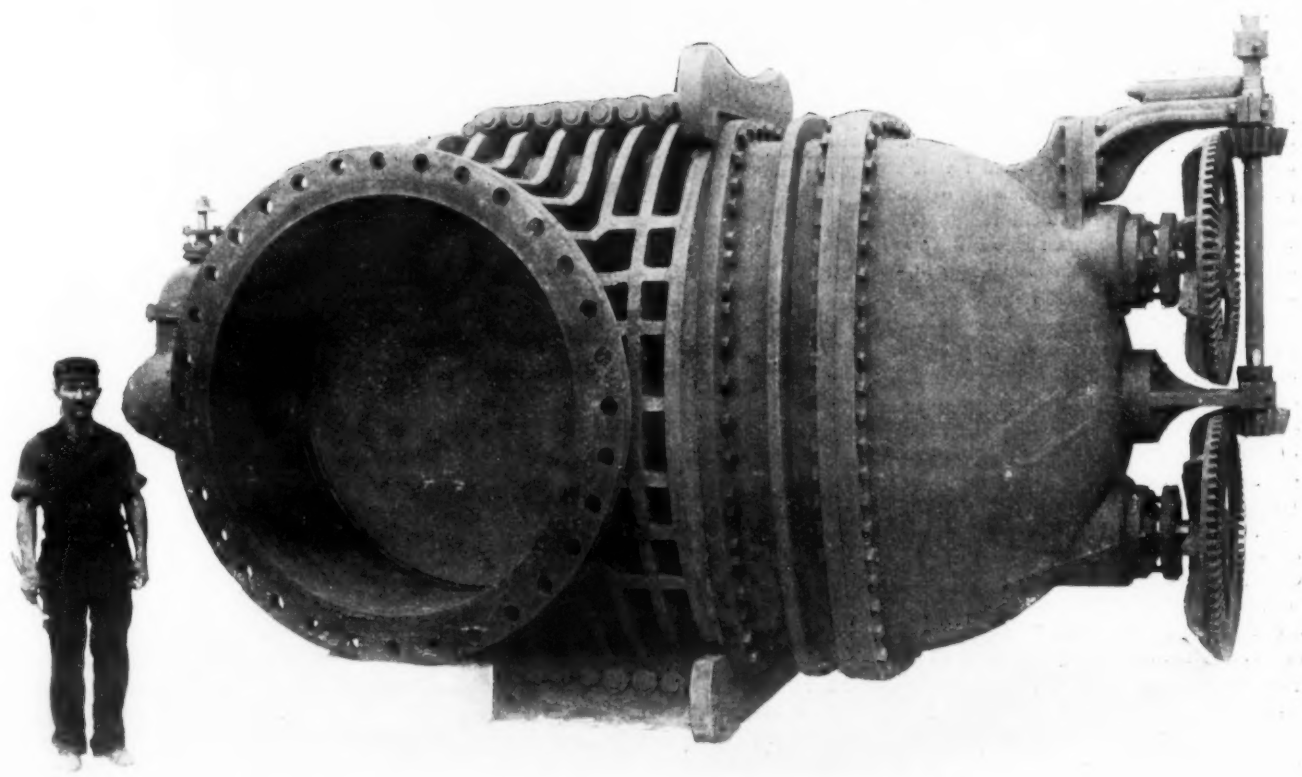
Piedmont Park, Atlanta, Ga., Sept. 11, 1895.

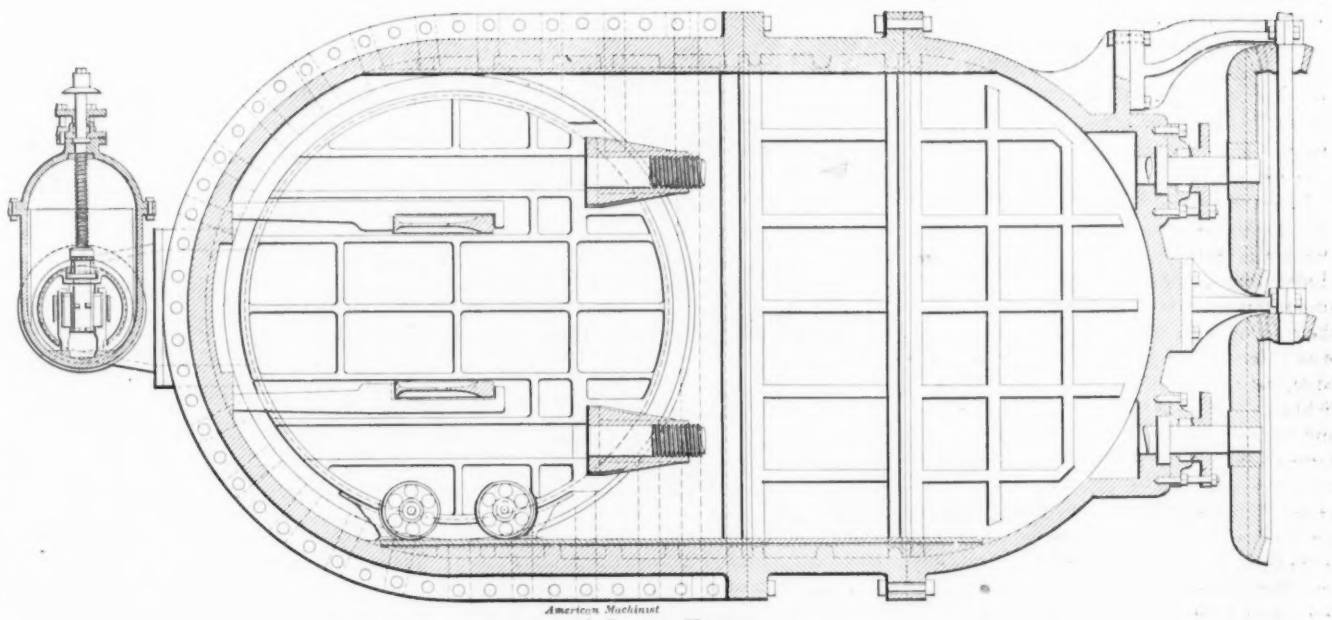
A Large Straightway Valve.

Our readers will be interested in the large valve shown in the accompanying illustrations. The half tones are from photos of one of ten similar valves recently made by the Rensselaer Manufacturing Company, Troy, N. Y., for the new water supply at Allegheny, Pa. The valves are to be used in the position shown, the spindle operating the main valve and also that for the 12 inch by-pass rising vertically. The water way of the valve is 60 inches in diameter. (The 60-inch machinist will be recognized as the genuine article.) The valve as it lies is 16 feet long, 9 feet high, 5 feet 6 inches from flange to flange, and weighs 55,000 pounds. It is, of course, principally of cast-iron with 2,000 pounds of brass or composition for the wearing surfaces. As the valves are tested to a pressure of 200 pounds before leaving the works, we may form some idea of the strength required, and the views given show the ribbing of the shell quite effectively.

This valve possesses several features of interest besides its size and weight. The gate is operated by two solid bronze spindles with screws 4 inches in diameter upon their inner ends, geared to always move together and so that one or two men can operate them. As the gate to be moved weighs upward of six tons it is by no means an easy matter to move it under the most favorable conditions. Friction rollers are provided to sustain the weight, and these travel upon a non-corrosive bronze track fitted on the bottom of the shell. Where such rollers have been used without this latter provision their operation has been very unsatisfactory on account of the corrosion of the metal and the obstructions provided by the industrious barnacle. These valves possess a special and distinctive feature, not found in other valves, in the scrapers that are provided in advance of the rollers in either direction, that plow up the accumulations of silt or any hard deposit that may form upon the track of the valve. When the valve is to be moved these scrapers act like the pilot on the locomotive and keep the track clear. They have been used upon valves made for the city of Rochester, N. Y., with gratifying success. Each valve is transported complete upon a special car that has been provided. In describing the valve, of course, the daily paper had to get in its deadly work: "The valve was built thus strongly to withstand the expansion and contraction of a five-foot continuous riveted steel pipe, which in the difference in temperature between summer and winter exerts upon the valve a force of nearly 900,000 pounds." Here is where some of these elastic bolts which we have been hearing about would be of service.







A LARGE VALVE.

A Locomotive on Stilts.

Some time ago we were asked to illustrate or to give an opinion upon a new scheme of locomotive construction, which differed from the usual locomotive only in placing under the ordinary wheels a system of trucks resting upon the rails and supporting, directly upon their wheels, the regular wheels of the locomotive. We now learn that such a locomotive is being built at the Baldwin Locomotive Works, and it is set forth that with this engine 90 miles an hour will be easily attained, because owing to the arrangement of the truck wheels, the engine will be advanced twice as far during each revolution of the driving wheels, as would be the case if the driving wheels rested directly upon the track. Great things are expected of it, though not, of course, by the Baldwins, who seem to have no interest in the matter except to get their pay for the locomotive.

The only redeeming feature of the contraption, so far as we can see, is in the fact that it involves no important change in the locomotive itself, so that when the absurdity of the invention has been demonstrated it will only be necessary to remove the stilts and use the engine in the ordinary way.

In Defense of Patent Practice.

BY R. D. O. SMITH.

I believe our American system of patents is not only the corner-stone but the greater part of the foundation of our national prosperity. I believe that it furnishes the only solution to that apparent commercial paradox—our ability to pay higher wages and higher prices for material and still undersell those who pay less wages and less for material. I believe that the good done by this system is enhanced by a correct understanding and injured by erroneous ideas. If I did not so firmly believe these things, misstatements in papers like the AMERICAN MACHINIST would not worry me.

In your issue for September 5th, p. 707, I find a description of a patent for a steam engine, which, according to the writer, "violates nearly, if not quite all, of the laws of steam engineering." This may be so, and very probably is, but when he adds, "Is there not something wrong in the system, or in the rules of practice that can make the issue of such a patent possible?" he sails out into a sea of which he evidently has no

chart. Before asking that question he should have inquired, if *any* human system or rule of practice ever worked without hardship or wrong to someone, and another, why should more be expected of the patent system than of any other human institution.

The officers of the Patent Office are necessarily human beings like the rest of us and are no more capable of accurately forecasting the future of a contrivance which is absolutely as new to them as to the rest of the race.

The statute requires that an invention, to be patentable, must be both new (novel) and useful, but it does not require that the invention shall have been actually worked on a commercial scale, or been worked at all, and very few have been worked on a commercial scale before patent, while a very large number have not been worked at all.

Like all other human institutions, the patent system is a compromise. If as a prerequisite it were necessary that utility should have been commercially tested, it would cut off far more beneficial inventions than trivial or erroneous ones, because the greater number of inventors are too poor to test their inventions, and capitalists will not do so until the protection of a patent has been secured.

The law of 1836 had not long been in operation before the exercise of official judgment as to "utility" became an unbearable hardship. Patents were refused because in the judgment of the Patent Office the inventions lacked utility, and it will be easily understood by everyone who has had a little experience, that the more radically novel and far reaching an improvement is, the fewer will be the number of men who believe in it until after demonstration. So it was in the Patent Office until the Supreme Court ruled that the word "utility" in the statute is to be understood in the sense of "not harmful to the public." Utility is to be presumed unless there is evidence of positive harm. The rule, therefore, which eliminates inquiry as to utility, is not the outcome of laxity, or fancy, but of sore experience, which convinced the Supreme Court that it was absolutely necessary to rescue inventors from the human doubts of officers in the Patent Office, who have duties to perform, but neither the knowledge nor means of gaining that knowledge which would enable them to utter intelligent judgments on this question.

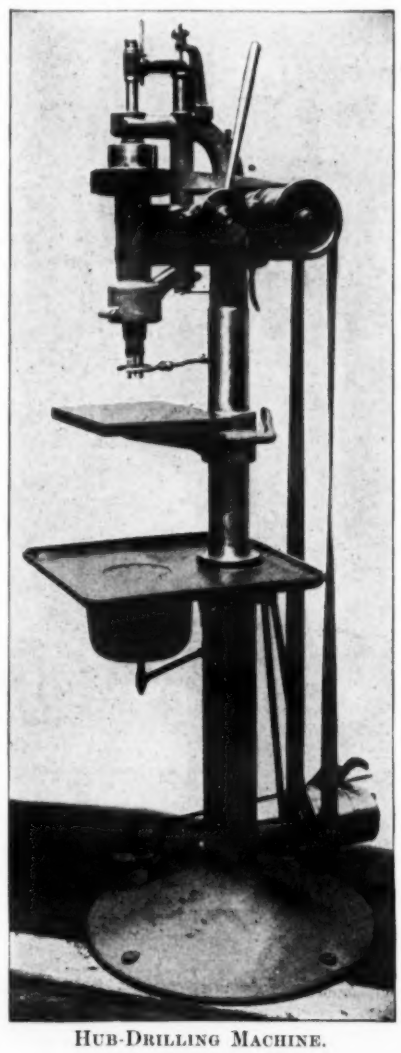
If it had rested on the examiners' judgment as to utility, Sickles would not have had a patent for his cut-off, nor Morse for his telegraph, nor Bell for a telephone, nor would thousands of other important inventions have triumphed over the disbelief of the Patent Office.

The occasional grant of a patent which has no good in it can hardly warrant the barring out of really valuable inventions which the inventor is pecuniarily unable to demonstrate.

There are several classes of persons named by your writer who do not deserve the notice given them. It may be reasonably concluded that patent attorneys are not more unscrupulous than other persons who serve their fellow men, and those among them who "fatten" are, to my personal knowledge, rather the exception than the rule. When a man wants a patent he wants it, and he has straightway suspicions of an attorney who tries to dissuade him. In ninety-nine cases in a hundred he will not rest until he has his application in the Patent Office. The credulous capitalists may be safely left to their fate. In the course of a tolerably long life I have never met one. In fact, men who are credulous don't become capitalists—now and then they are mistaken in judgment like other men, but it is not credulity which catches them. It seems to me that the inventor of a worthless thing which still has in it something so novel and so valuable that it hopelessly bars the way of something valuable, has, after all, builded better than he knew, and that he does not deserve imprecations for that. Besides, the hopeless barring is moonshine. The proprietor of a worthless patent is always ready to part with it for a modest sum. If he is not, the judgment as to its worthlessness may be premature.

If it *is* worthless it cannot possibly bar something which is valuable. If it actually does bar the valuable invention it simply shows that the latter rests upon something not devised by its inventor.

The important thing seems to be overlooked by your writer, to wit, the patent is



HUB-DRILLING MACHINE.

a contract which costs the patentee something but costs the Government nothing. It purports to guarantee him the exclusive right for 17 years, and that nobody has any right to disturb him during that period. If it is valuable it belongs to him and no one has any right to claim or to use it. If it is worthless it is equally his, but no one else will want to claim or to use it. So far as the general public is concerned, they do not know nor care anything about it one way or the other. If the thing is valuable the public don't want it and won't have it until the patentee has crammed it down the public throat. If it is worthless it won't go down, and that is the end of it.

Multiple-Spindle, Bicycle Hub-Drilling Machine.

In former issues we have illustrated some multiple-spindle drilling machines, designed especially for light work, and having small spindles cranked at their upper ends, and driven by engagement with a wrist plate which is driven by a crank upon the lower end of the main spindle. All the wearing parts being made of steel, hardened and ground, and the mechanism thoroughly balanced, the spindles can be driven at any speed required by the drills, without noise or vibration.

Our present illustration is of a machine built on this plan, which we saw running recently in the shops of its builders, the Langlier Mfg. Co., 67–69 Clifford street, Providence, R. I. With the "drill head" shown in place the machine is fitted for drilling spoke holes in the flanges of bicycle hubs, but things are so arranged that by loosening one clamping bolt this head with its spindles can be slipped out of its socket and one with a different arrangement of spindles substituted for it, the change being very readily made.

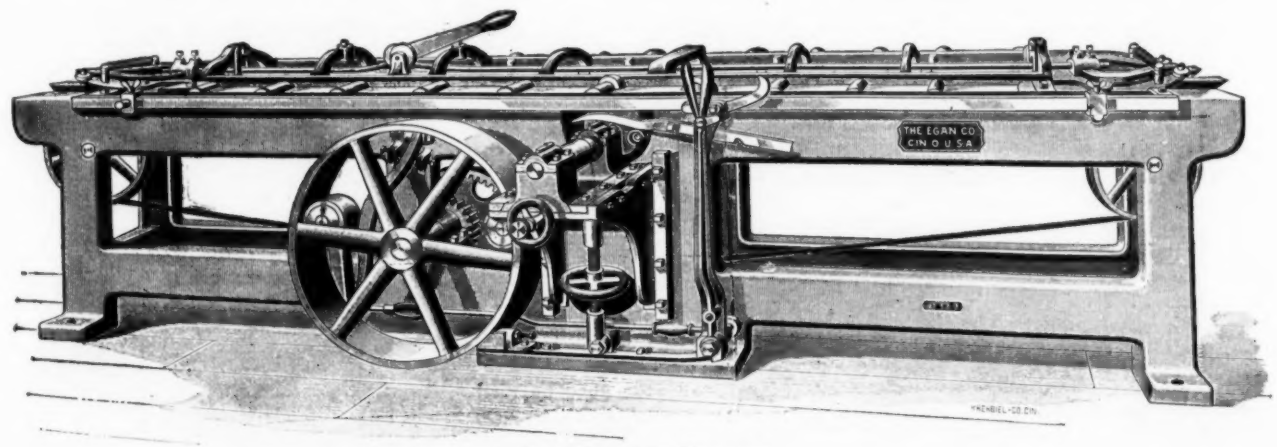
With the head shown eight $\frac{5}{16}$-inch holes can be drilled through $\frac{5}{32}$ inch stock, and at the same operation counterbored $\frac{1}{64}$ inch diameter, $\frac{1}{32}$ inch deep, in 30 seconds, including the time required to place the piece.

The machine is provided with two speeds. A small lever at the back of the column raises and lowers the idle pulleys in line with either pulley on the spindle cone, the belt being equally tight on each. An oil tank and pump, the latter driven by a small belt, are provided, and attached to the slide is a small rod, moving vertically with the drills, which shuts off the flow of oil or water when the drills are raised from the work, and turns it on again when they are fed down.

The lower fixed table catches all the oil, which drains through a grid back into the oil tank, so that no oil is wasted, and the shop floor is kept clean.

A New Automatic Glue-Jointing Machine.

The accompanying illustration represents an improved machine for automatically jointing material, making a perfectly matched joint of any desired shape on any kind of wood, from 3 inches thick to veneers, and up to 18 feet 6 inches long. It is especially valuable for making tight joints in staves for tank work. Two pieces of stock are jointed at the same time, one on either side of a central fence on the table. The machines are made in different sizes to joint material from 8 feet 6 inches up to 18 feet 6 inches, and no matter how heavy the stock to be jointed, or how long the table, the machine works freely. The frame is stiff and heavy and of ample size, planed and bolted together, so that the machine runs steadily under all conditions. The table is planed true, and with means provided for taking up lost motion will clamp two boards of uneven thicknesses, bringing them to a straight line against the central fence by means of a single lever and at one operation. The face of the fence being planed it will not mar the stock brought in contact with it.



GLUE-JOINTING MACHINE.

The mandrels are of cast steel of ample size and each driven independently. They carry a full set of shimmer heads or saws, as preferred, making a perfectly matched joint of any desired shape, the curved or irregular joints giving more gluing surface than can be obtained with any other machine. Dispensing entirely with rack and gears, the feed is noiseless and self-reversing, with quick return of carriage and perfectly automatic. The rate of feed may be increased or decreased at the will of the operator, and the travel of the carriage regulated by means of adjustable stops to suit the length of the material. An ingenious automatic device controlled by the feed lowers the mandrels and boxes below the cut, so that the stock in its return is clear of the cutters. The machine is simple in design, is not likely to get out of order and does not require special skill to run it. It is built by The Egan Co., 239 to 259 West Front street, Cincinnati, Ohio.

New Pattern Letters.

We present herewith an engraving showing a new idea in pattern letters.

We all know the trouble caused by pattern letters and figures which will not stay in their places and thereby cause castings to appear sometimes with anything but the right symbols upon them. This trouble is

is intended to avoid by the use of these letters, which are made of brass, and, instead of being secured by shellac only, have cast upon them small spurs as shown, which are driven into the wood and prevent displacement.

In putting these letters and figures on it is found most convenient usually to press the points through a strip of paper and then use the paper as a marking template on the pattern.

The letters can usually be removed from old patterns and used on new ones, and, being of brass, they can be readily soldered to metal patterns if desired.

They are made in three sizes—$\frac{1}{2}$ inch, $\frac{3}{4}$ inch and 1 inch, by Twining Campbell, 153 Liberty street, Paterson, N. J.

The British Cruiser "Terrible."

Some particulars of the latest monster of the British Navy we have no doubt will be of interest to our readers:

Length over all, feet	538
Length between perpendiculars	500
Breadth, extreme	71
Depth to upper deck	43.25
Draught, mean	27
Displacement, tons	14,200
Coal capacity	3,000
I. H. P., natural draught	25,000
Speed, knots	22

The hull is double. The two bottoms are 4 feet apart at center and 2 feet 6 inches at the bilge, increasing to 4 feet at the protective deck level. In the region of the machinery the depth is increased to 8 feet, and a series of plate girders binds the bottoms together with thwartship intercostals. The stem, 15 tons, and the stern post and A frames, 50 tons, are of phosphor bronze, and the two screws, 21 tons each, are of manganese bronze. The total bronze used is 162 tons. The hull is sheathed outside with 4-inch teak plank. The rudder, which is partially balanced, has an area of 250 square

feet, and is covered with rolled brass plates. The hull is divided into 236 water-tight compartments of various capacities. The space given up to the machinery, 252 feet long, is divided by a middle longitudinal bulkhead and transverse bulkheads into ten compartments, two being used for the main engines and eight of them for the 48 Belleville boilers.

The engines are wholly under the protective deck, the stroke and length of connecting rods having been shortened to accomplish this. The engines are of the four-cylinder triple-expansion type; high-pressure, 45 inches diameter; intermediate, 70 inches, and two low-pressures, 76 inches; stroke 4 feet. The high-pressure cylinders are forward, and have piston valves of the inside type with adjustable packing rings, while the other cylinders have treble-ported flat valves, with a special type of relief frame to relieve the pressure, and the weight of all the valves is balanced to reduce the strain on the valve gear. The cylinders, steam jacketed, are independent castings, but are all bolted together, and for stability in case of ramming struts are fitted between the forward cylinder and the structure of the vessel, as well as transversely between the respective cylinders in each engine room. Each cylinder is supported on four cast-steel columns. The valve gear is of the double eccentric link-motion type, and is reversed by means of a double cylinder engine attached to one of the cast-steel front columns. Each of the reversing levers is provided with screw gear, so that the valves of each cylinder may be linked up independently. The pistons, cylinder covers and steam-chest doors are of cast-steel. The piston and connecting rods are of Siemens-Martin steel. Metallic packing is provided for the stuffing boxes of piston rods and valve spindles, both of the main engines and of all auxiliary engines. The crank shafts are hollow, each crank being a separate piece, and all interchangeable, with journals 20 inches external diameter and 10 inches in internal diameter. The crank arms are cut away as much as possible for lightness and for convenience in fitting the centrifugal lubricators. The thrusts are of the horseshoe type, with eight collars to each. The thrust shafts and propeller shafts, which also are hollow, are 18½ inches in diameter inboard and 20 inches outside the ship. The propellers are three-bladed, 19 feet 6 inches in diameter, and work inwards instead of outwards as heretofore the practice. Twenty-five thousand square feet of cooling surface is required in the condensers, and the tube casings as well as the ends of the condensers are built up entirely of naval brass plates riveted together. The steam is condensed outside the tubes, which are ⅝-inch diameter and .05 inch thick, the circulating water passing through them. The water is supplied by four Gwynne centrifugal pumps, each driven by an independent engine. With steam at 150 pounds, these pumps are capable of discharging 1,500 tons of water per hour from the bilge. A double cylinder reversible engine is placed above the starting platform for turning the engines. With compound worm gearing, the worm wheels having machine cut gun metal teeth, and the main worms being of manganese bronze, the engines are capable of turning the main engines completely around in eight minutes.

There are 48 boilers on the "Terrible," of seven and of eight elements, located in eight boiler rooms. There are four funnels of oval section. They are of different cross-sections, but with the longitudinal dimensions alike for the sake of symmetry. The hight of each funnel is 80 feet from the grate. To supply the air for complete combustion, eight air-compressing engines are provided—four with double cylinders and four with single cylinders. The total grate surface is 2,200 square feet, and the heating surface is 67,800 square feet. The pressure in the boilers is 260 pounds, which is reduced to 210 pounds in the high-pressure steam chest. The junction boxes are of malleable cast-iron $\frac{5}{16}$-inch thick, and the tubes, mild steel lap-welded, 6 feet 8 inches long, 4½ inches outside diameter and varying in thickness from ⅜ inch for the lower to $\frac{5}{16}$ inch for the upper rows. The pipes are screwed into the back boxes, the pitch of the screw on the tube being slightly different from that in the box, so as to form a tight metallic joint. A jam nut is added for greater security. For the front ends, instead of both tubes entering the box, one is connected by means of a screwed coupling nut to a projecting nipple. This arrangement is adapted to facilitate the removal of the tubes which form the elements. The main steam pipes are of mild steel, as are also the receiver pipes.

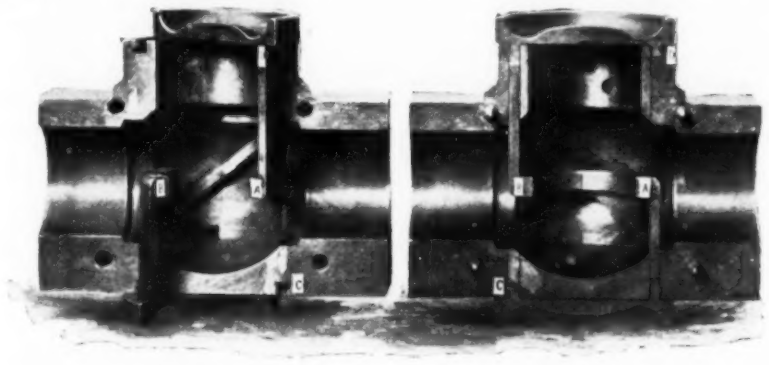


Fig. 1.

Fig. 2.

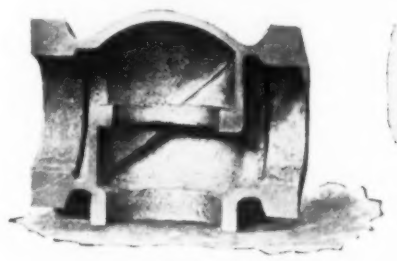


Fig. 3.

Fig. 4.

CORE BOXES FOR VALVES.

Of the various services performed by the auxiliary engines, space will not permit even the mention. The following list of the *sets* of machinery in the ship is sufficiently suggestive without any explanatory remarks:

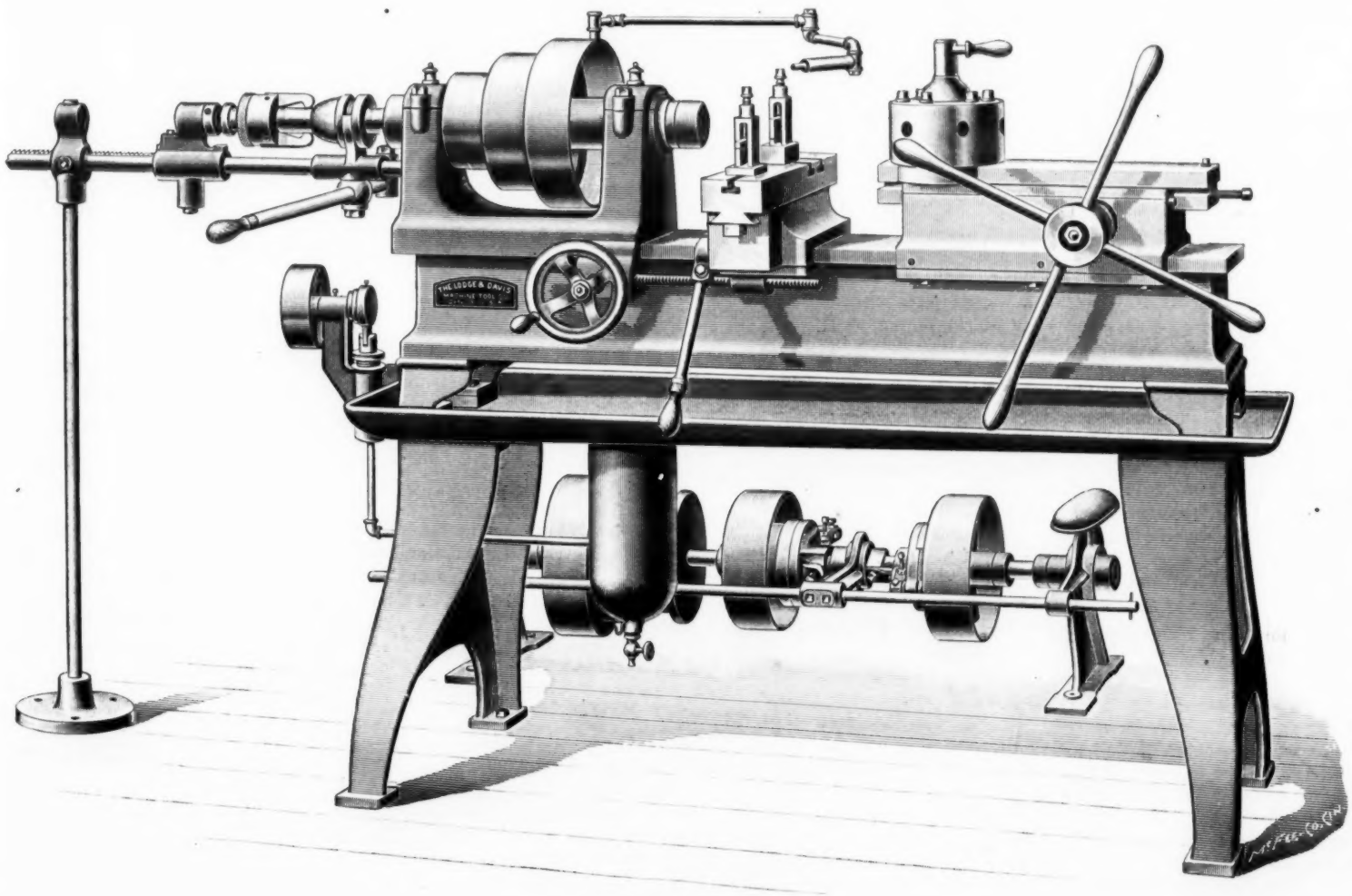
	Sets.
Main engines	2
Reversing engines	2
Turning engines	2
Main circulating pumps	2
Auxiliary circulating and air pumps	4
Main feed pumps	6
Auxiliary feed pumps	8
Fire and bilge pumps	4
Drain tank pump	1
Distiller pumps	2
Air compressors for air jets in Belleville boiler	8
Fan compressors for stokeholds	12
" " " engine rooms	2
" " " ship ventilation	4
Electric light engines	3
Air compressors	4
Steering engines	2
Boat-hoisting engines	2
Coal " "	2
Ash " "	12
Engine for workshop	1
Capstans, fore and aft	2
Total sets of engines	87

The armament consists of two 9.2 inch, 22-ton guns, twelve 6-inch rapid fire, sixteen 12 pounders, nine machine guns, and four torpedo tubes.

Screw Machine.

We present herewith an engraving of a turret head screw machine, with automatic revolving turret and Parkhurst rod feed, with hole through plunger large enough to take 1¼ inches stock.

The spindle is of forged crucible steel running in bronze boxes having provision for taking up wear. There are taper gibs on the turret slide for taking up wear and preserving alignment, and the turret has a hard steel index ring. Pump, oil pan, etc., accompany the machine, which is made by The Lodge & Davis Machine Tool Co., Cincinnati, Ohio.



SCREW MACHINE.

A Novel Core Box for Globe Valves.

Our illustrations herewith show a novel and improved mode of making the cores for globe valves, which has been devised by Mr. John Scheider, of Washington, Pa. It has been the practice to make the cores for globe valves in two separate pieces, uniting them by a central pin, with the result that all the parts of the core have not been accurately and securely located, and that the partitions and walls of valves made with these cores have not been always of the required thickness. Mr. Scheider after considerable experience with regrinding and repairing these valves and discovering the uneven thicknesses of the metal consequent upon defective cores, determined to make a core that should produce more correct and reliable results, and we have pleasure in presenting his system to the readers of the AMERICAN MACHINIST.

It will be seen that with this core box the entire core is made in a single piece. Figs. 1 and 2 show the two halves of the core box, Fig. 3 shows the core and Fig. 4 shows one-half of a shell that has been cast with

this core, showing the truth and evenness of the several parts of the casting. The half tone is made from a photo of a 2-inch valve that was planed down to show the interior.

The construction and operation of the core box will be readily understood from the illustrations given. The parts of the box which form the partitions in the core are removed by a circular movement. When one-half of a revolution has been made, the partitions are entirely free from the core. The top half is turned to the right and the bottom half to the left, or *vice versa*. Fig. 1 shows the partitions in place for making the core, and Fig. 2 shows them partially revolved in the process of removal. It will be noticed that Figs. 1 and 2 represent the two halves of the same core box. When the partitions have been removed, a little paste is applied to the faces of the half cores, and upon putting the core box together, the halves of the core are accurately matched and united. The views of the core and the casting speak for themselves.

LETTERS FROM PRACTICAL MEN.

Expansion Collars.

Editor American Machinist:

This device, as shown by Mr. Willis in your issue of August 22d, is a good idea, but would it not harmonize better with the rest of the milling machine if there were some graduations on the edge of the collars? A friend of mine who has charge of the milling work in a large shop has a similar device, only the two parts are threaded together, somewhat like the tool-post ring on a Barnes lathe, and he has the edge graduated to read approximately thousandths of an inch. The straddle mills are first set slightly too far apart, and the first piece milled, after which it is calipered with a micrometer, and the expansion collars closed by just the amount that the work is over size.

WALTER GRIBBEN.

A Job of Blacksmith's Work.

Editor American Machinist:

Across the street from Smith & Black's there was a smith's shop; they used to do all of our work and a deal of jobbing work besides. They ran six fires, all with the old-fashioned hand bellows; the new firm, when they got hold of it, put in a blower and some other new-fangled ideas, but what I started to tell happened before that.

One day, just before twelve, in came one of those tramping jours., one of those really good workmen who can't be contented to keep a good job when they get one, but must be "on the go."

Well, he went up to the "boss" and asked him for a job; the boss gave him a look and asked him could he "weld two pieces of iron together." A look of disgust came over the face of the tramp as he replied, 'Give me a chance and I will show you." "All right," said the boss, "here is a good fire and tools, and I am going to dinner. Take hold and show what you can do," and off he went.

Mr. Tramp took a look over the boss' kit and picked out the two best pair of tongs he could find, clasped them together, putting the jaws of one pair into the jaws of the other, slipped a ring onto the handles of each, and taking a good welding heat he made as pretty a weld as I ever saw, finished the job up in an A No. 1 style, laid the tongs on the boss' anvil and went his way.

The foreman's face, when he came in at one o'clock, was a study; he looked the job over, and with mingled disgust and admiration in his voice, said: "If that blanked fool was here I would give him a job—such impudence should not go unrewarded."

A. P. PRESS.

Loose Piston Ring in Steam Pump.

Editor American Machinist:

In reply to Question (325) J. F. B., Spokane, Wash.:

The r-t, r-t in his pump cylinder is caused by loose piston rings, that is, the rings have lost motion in the direction of the piston travel; if J. F. B. will take a shaving off of the follower plate so that it will crowd the rings up snug against the piston and prevent end play, he will cure the grunt in his steam cylinder; that is the remedy in this neck of the woods.

W. K. HOWELL.

Kansas City, Mo.

Strength of Gear Teeth.

Editor American Machinist:

I had imagined that before one ventured to criticise the remarks of another, it was desirable, if not absolutely necessary, to first endeavor to understand them. Probably Mr. Webber, with his long and somewhat novel experience, thinks this quite a superfluous detail in my case, and I must admit that I am very sorry this should be so, as I am convinced that if he wrote his letter after having *read* my contribution, that either he did not understand it in the least, or that he willfully misrepresented my statements. As I should be very sorry to lay this latter charge to Mr. Webber, I am inclined to believe that he has not honored me by a careful perusal of the contribution which he thinks such utter nonsense. I would therefore refer him again to the article in question, and now apply myself to the pleasurable task of enlightening Mr. Webber on one or two points.

My critic says that it took him not quite half a minute to find the 23 different rules to which I referred. Here Mr. Webber makes his *first* mistake, for of the rules I mentioned, one or two at least have never appeared in print. Mr. Webber's second and more egregious error, is in assuming that I advocate 1,000 pounds per square inch as a suitable safe stress. It is quite true that the table is calculated on this basis, but for the sole and ample reason that it enables any desired stress to be adopted with facility, as fully, and, I trust, clearly explained in column 3, page 645. I might, of course, have used a stress of 1 pound per square inch for the table, and indeed my only objection to this was the number of ciphers which would then be introduced, and which could be altogether avoided by the plan I adopted.

If Mr. Webber will refer to the last paragraph of my article, he will find a number of suitable stresses given for varying conditions of service. And if, as he leads us to suppose, he finds one rule suitable for all sorts and conditions of gear teeth—he may consider himself more fortunate than most of us. In the same paragraph I mention that several of the more reliable tables of horse power of gears involve a stress of from 2,000 to 2,500 pounds per square inch. If we adopt the lower of these two values, Mr. Webber will see that the horse-power in his first case is 102.6.

The statement that the table reduces the power of gears to one-third that allowed by Boulton & Watt, while increasing the stress from 480 to 1,000 pounds, is, of course, quite absurd. I must ask for a little enlightenment on what is meant by a stress of 500 pounds on a cast-iron *cube*.

Mr. Webber's remarks that no sane man would put up gears which would be subject to corner breaking, and that no good mechanic would allow them to run so, is, of course, very tall talk, but it is calculated to lead one to suppose that Mr. Webber's experience in these matters has neither been so extensive nor as varied as he would have us believe. But, however this may be, as my table is quite as applicable to those cases in which *even* bearing can be relied upon, your correspondent's strictures on that part of the question altogether fall to the ground.

M. E.

Architectural Machine Designs.

Editor American Machinist:

I have lately been impressed, as no doubt your readers generally have been, by the variety of information and the soundness of the views presented in your editorial columns. An illustration of the latter is given in to-day's issue, in the article on "Architect's Machine Designs." This is a subject in which I have always been deeply interested. We are chiefly indebted to Mr. Whitworth for the emancipation of machine tools, and it may be added of machinery in general, from slavery to architectural forms, which were found by him universally prevalent in mechanical construction. He invented the box form of framing, the rigidity of which, under every variety of stress, is fundamental to truth in machine work.

When, in 1866, the manufacture of the Porter-Allen engine in England was undertaken by his company, I had the pleasure of showing him an engine bed which met with his critical approval, especially after I had pointed out to him that in designing it I had done little more than apply to the steam-engine framing his designs for the framing of machine tools. In the course of a conversation on the general subject, he exclaimed, "Let no one show me a mechanical design for which he cannot give me a mechanical reason."

Mr. Whitworth had done so much, in such a variety of ways, for the advancement of mechanical construction, had received such universal laudation, and had amassed such great wealth, that it was not to be wondered at that he should have formed the idea that he had done all that there was to be done. Years before my acquaintance with him, seeing no more problems to be solved, no more worlds to conquer in the field of machinery, his bold and restless genius turned to gunnery, and he conceived the grand idea of revolutionizing the artillery of the world, in which, however, he was doomed to be finally disappointed. But at that time he was in the full tide of what promised to be successful experiment and negotiation with various governments. I confess that I was excessively amused at being told by him that he had "long entertained the idea of designing the standard steam engine, that is," he explained, "an engine embodying all the fundamental principles, to which the builders of steam engines must, sooner or later, come." He added that his attention had been and was then so much engrossed in gunnery that he had as yet been able to give but little thought to the subject, but he still hoped to undertake it when he should have got his present job off his hands. It must be said that he did afterwards contribute to steam-engine construction the hollow steel shaft, a specimen of which was regarded as the most important single exhibit in the Paris Exposition of '78.

CHAS. T. PORTER.

Brakes on the Trolley Car.

Editor American Machinist:

In your issue of September 5th, in the editorial, "The Brake on the Trolley Car," referring to the killing of a child by a Brooklyn trolley car, you state: "It is reasonably certain that the life of the little child referred to above would not have been sacrificed if the car had been without a fender, or, especially, if it had been equipped with an efficient brake, but the motor gearing might have suffered, and so an instantaneous brake cannot be permitted on a trolley car."

No car, trolley or otherwise, is likely to be equipped with an "instantaneous" brake, since the effect of the application of such a brake, if it were possible to make one, would be very much the same as that of a collision on car and passengers.

If all you mean by "instantaneous" is "quick acting," the Lynn & Boston Street R. R. had a successful air brake in use on their main line, Boston to Lynn and Swampscott, two years ago, the motive power of the cars being electricity and the trolley being used.

The air is pumped by one of the car axles while running, and I never heard of any trouble with the motor gearing from the use of the air brake.

If your Brooklyn cars are not equipped with air or electric brakes it is not for lack of good brakes, but simply because the management does not choose to invest in such brakes, which naturally cost more than the hand brakes.

F. M. JAMES.

Haverhill, Mass.

[When a trolley car is to be stopped it should always be possible to *apply* the brake instantaneously and with full pressure. This does not mean an instantaneous stoppage of the car, but a stoppage as quick as possible, and if any trolley cars are stopped as quickly as possible, or can be so stopped with the brakes they employ, we have not seen them. —ED.]

The Largest Drop Hammer.

Editor American Machinist:

The statement on page 703, of your issue of September 5, 1895, as to size of drop hammers made in this country, is hardly correct. The Waterbury Farrel Foundry and Machine Co. have made at least one 1,500-pound hammer; and it is my impression that Miner & Peck, of New Haven, have also made one of like weight.

I think you will find on investigation that such hammers have been made as heavy as 2,000 pounds, and in this country.

Collinsville, Conn. G. D. COLTON.

Foundry Cost-Keeping.

Editor American Machinist:

In a recent issue I noticed a query about cost sheet for foundry. I take the liberty to inclose one filled out from my copy book, bearing the date August 26, 1891, or just four years ago; at which time I was connected with the Durango Steel and Iron Co., of Durango, Mexico. The sheet I found very convenient, and it answered our purpose in keeping cost of castings.

FOUNDRY REPORT FOR ~~MONTH~~ 6 days ENDING Aug 26th 1891

LABOR AND MATERIALS USED

Labor from Pay Roll	Fuel: Wood Am't	Fuel: Wood Cost	Fuel: Charcoal Am't	Fuel: Charcoal Cost	Coke Am't	Coke Cost	Iron Am't	Iron Cost	Sand Am't	Sand Cost	Am't	Cost	Sundries Am't	Sundries Cost	Total
82 23															82 23
	100	6 25	26	3 50	45cw	33 75									9 75
							12,300	474 75							33 75
							5t	378							276 75
							2cw	15 12							15 12
							3cw	19 20							19 20
													4 75		4 75
															441.58

PRODUCT

Good Castings	Waste & Scrap	Loss	Cost Castings per pound	Value	Remarks
11,039	1,719	240	3.691	407 90 33 68 $441 58	Two heats one soft for machine castings, and one hard for shoes and dies.

W. Viggers Foundt

FOUNDRY COST SHEET.

It simply deals with things passing into the direct production of castings, and is made up from the cupola charger's blackboard, and store and time-keepers' books; such items as investment, depreciation, etc., are left to the office discretion. The sheets cover six days' work, although the blanks were printed for one month, but it was found too long a time to carry the items on the blackboard, so they were taken off weekly. It is probably necessary to make an explanation of the items, wood, charcoal, silicon and manganese, as these are not items commonly used in foundries.

The company's works are located at the foot of the famous Cerro de Mercado, from which mountain they obtain their

ores, doing their own smelting, and producing their own pig, using charcoal for fuel; but the product being principally mill iron, and the ores naturally tending to a low silicon iron, and fuel (charcoal) costing 14 cents per aroba of 25 pounds, or $11.20 per ton on the scales, it became a question of dollars and cents how to produce iron for machine castings. To import foundry iron was out of the question, as freight alone from the nearest railroad point (130 miles) cost $30 per ton of 2,000 pounds, then added to this the railroad freight and duties, duties alone of $20 per ton, so we bought ferro-silicon of the highest percentage we could get (13.5), and with this at a small additional cost we were enabled to produce machine castings of any degree of softness, at will. I may say that our pig rarely ran over 1⅛ per cent. silicon, with practically no sulphur, and less than .05 phosphorus. Then came another question of a suitable iron for the wearing parts of the different ore-crushing machinery used in this country, such as shoes and dies for stamp batteries, and pans, tires and dies for Chilian mills, and rolls for Cornish rolls. That we had a splendid base, tough, close, mottled, charcoal iron, we knew, but still it lacked the staying quality, which the addition of ferro-manganese give it, so that with the silicon and manganese, we could produce from one common stock almost any class of iron needed. Wood we used for steam and core oven purposes, and charcoal for skin drying and cupola beds, as a little charcoal assisted in lighting the coke; coke cost, laid down at works, $45 per ton of 2,000 pounds, and wood 6¼ cents per aroba of 25 pounds. I may be asked why did we not use charcoal altogether in our cupola; the reason is, that we were unable to get the iron fluid enough to expel the graphitic carbon, and the result was imperfect castings. W. VIGGERS.

Durango, Mexico, August 26, 1895.

[Our correspondent's cost sheet seems to be clear and simple, except that it does not appear how the price of his wasters and scrap was determined. The price seems to have been 1.0196 cents per pound, but why that price? This question has come up lately, especially in connection with one or two letters whose writer chooses to sign himself "A Blockhead."—ED.]

The Monkey Wrench Made for Abuse.

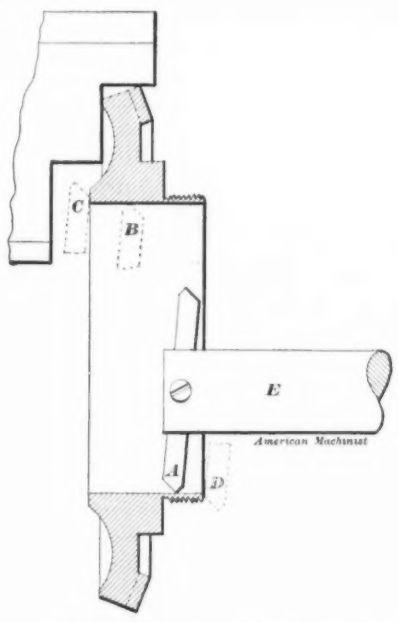
Editor American Machinist:

In your issue of August 29th, Orosco C. Woolson gave quite a treatise on the monkey wrench, in which he lays down certain rules for the use of the tool. In reply let us consider the purpose for which the wrench is made. I think I make no mistake when I say that 99 per cent. of the machinists believe (and correctly too) that it is the intention of the manufacturer that the wrench should be used in any way it may be found necessary, either as illustrated in Fig. 1 or 2, or side ways, circumstances and the inclination of the person using the tool alone to determine the question. The monkey wrench is made to *use*, abuse is a word that can hardly be applied to the tool. I have known the monkey wrench for over 40 years, and have been in a few shops both East and West, and have seen some scrap heaps at foundries and rolling mills, but I have as yet to see one made up of broken monkey wrenches, or one in which it predominates. In all my years in the shop and factory, I do not think I have seen two dozen *broken* wrenches, and but a *small* part of that number broken as Mr. Woolson indicates. I have seen quantities of the tool worn out in screw or nut. If Mr. Woolson will ascertain the number of machinists, and then take one-half of 1 per cent. of them he will find (according to his idea) how many there are who appreciate the one way to use the monkey wrench. But from that one half of 1 per cent., good Lord deliver us. I have a 12-inch wrench that has been in use some 30 years, and as he says, is as good as new, with the exception of bruises and general wear. If a monkey wrench is used it will show wear all over, but if it is locked up in a tool chest and other wrenches used, then the other wrench will be the one worn out, and the monkey will keep new. The screw wrench or hammer wrench is made to displace a chest full of solid end and other forms of wrenches not adjustable. The four sizes of monkey wrenches, 6, 8, 10 and 12 inches, take about two hundred weight of old iron out of the machinist's tool chest. In your editorial upon the same subject you say, "But in addition to the sins of ignorance and thoughtlessness, the monkey wrench fiend continually perpetrates others that are willfully and wantonly destructive. The use of the wrench for a hammer, the makers of the wrench are more or less to blame for, in continuing to make the head of the wrench in a shape suggestive of a hammer." Now Mr. Editor, that hammer head is put on the wrench for the very use which it suggests, *i. e.*, to hammer with, and when a man uses it that way, he is putting it to a legitimate use. A monkey wrench without the hammer head would not sell, except to the esthetic. No one ever puts a pipe on the handle of a wrench, except it is necessary, and under such circumstances it is proper and right to do so. The idea of a farmer carrying a cart load of solid-end wrenches into the field with him! *War is destructive*, but it is waged for a purpose, not simply to kill and raise sheol. MONKEY WRENCH.

A Boring Tool That Earns Its Salary.

Editor American Machinist:

Not long since I had some brass bevel gears to make which formed part of an optical instrument, and as there were over a dozen different operations on each one, including turning, threading and cutting the teeth, it was best to have the surfaces finished at the first operation as true as possible, as on these the truth of the subsequent operations depended, and of this first operation I send you a sketch, thinking it may be of interest. The castings were held in a four-jawed chuck, and the hole roughed out with the tool shown in full lines at *A*. The front end of tool also served to face the front hub, as shown at *D*. After this the lathe



was reversed and a finishing cut taken through the hole with back end of tool, as shown at *B*, and then the back hub faced (*C*); thus the hole and faces of both hubs being finished at one chucking, were pretty sure to be true with one another. As my slide rest has micrometer graduations on the screws, it was an easy matter to make all the holes duplicates of the first one, by bringing cross slide to the same setting each time for a finishing cut at *B*, and as this finishing cut was very light, the wear of the tool was not a conspicuous element in sizing the hole. Had it been inconvenient to reverse the lathe, the back end of tool could have been made with its cutting lip on the bottom, and all the cuts taken with the lathe running forward. The bar *E* is a piece of cold rolled shafting held in fixture in slide rest, and the cutting tool *A* ordinarily sticks through it at an angle of 45 degrees, but for this particular job I put a hole through its other end at an angle of about 5 degrees out of square, so the cutting tool would clear the chuck jaws when facing the back hub, as at *C*. WALTER GRIBBEN.

Brooklyn, N. Y.

Cyanide on Tool Steel.

Editor American Machinist:

Please allow me space for a few remarks in regard to the use of cyanide on tool steel.

In my experience, cyanide is of value in hardening stamp dies and other work where a hardened *surface* only is necessary.

When used to harden tools that require grinding, for instance, cutting dies, it will sometimes cause considerable trouble.

We know that by its use tool steel will harden at a lower heat, that large pieces of die steel will harden in oil at a much lower heat than they would, without it, harden in water.

I have worked several years on punches and dies, many of them piercing dies, quite delicate, and once in a great while, for fear of overheating, and thereby cracking, have dipped the die while underheated, and consequently it did not harden.

If, in this case, cyanide had been used, the surface only would have been hardened, the punches fitted and tempered, and then, at the first grinding, the die would be soft, and then a long delay.

Re-harden the die, it will change enough to make a refitting of punches necessary, so anneal punches, refit and temper.

Or if in the case of a blanking die the surface only is hardened when we attempt to cut in the punch, the case-hardened tool steel will not stand, and the die will be ruined.

For me, no cyanide on cutting tools, if hot enough to harden it will do it without; if not hot enough it will only case-harden, and that for cutting tools is useless.

RALPH S. OTIS.

Pittsfield, Mass.

A Wonderful Feat in Marine-Engine Repairing.

Editor American Machinist:

I inclose herewith a letter cut out of the *St. John Globe*, in reference to the breaking of the shaft in steamer "Greenwood," while on the passage from St. John, N. B., to the Island of St. Kitts, in the West Indies. I might say that this steamer was taken down by Geo. H. Waring, under contract with the Government to run between St. Kitts and Nevis. She left St. John on the 23d August and arrived at St. Thomas about the 21st November.

Thinking it might interest your readers to know how some difficult jobs are accomplished, I thought I would send this to you for publication.

When they found the shaft broken the first thought was: We will have to go to New York to have it repaired, but when they found it might be one or two months before a steamer might call, they found that would not do, and to take the shaft to an island where the steamer called, some 400 miles, in a sailboat, that was out of the question.

The only thing was to repair it on the island. A cask was procured, the only one on the island, having come ashore out of a wreck, the ends taken out and a bellows made out of it. A forge was then made. The next question was material to weld on shaft to keep the length. After a long tramp on the island a bar of ¾-inch by 3-inch iron was found; this was built up and made large enough to weld on end of shaft, which was then welded to shaft. You can imagine this work on the shore with the sun directly overhead; the inhabitants of the island in a circle around the forge, never having seen anything before like it, it was a picture not to be forgotten. To add to the difficulty the steamer had to be hauled out to get a chance to work at shaft. After a delay of two weeks the repairs were completed, they continued their passage, and I might say up to May of this year the steamer was running with the same shaft.

ONE OF YOUR READERS.

St. John, N. B.

[The essential part of the clipping referred to in the above letter is as follows:—ED.]

Great Harbor,
Long Island, Bahamas.

. . . We came in here for a harbor, and when we started a few hours later to continue our journey found that our shaft was broken. This was two weeks ago, and ever since then everybody has been busy at the work of repair. It is very doubtful if any such job as that just completed was ever before brought to a successful termination by any boat's crew. Without a forge, materials for work, dock, derrick, assistance, or anything else, we have got our shaft mended and are now ready for sea. . . . The coal, a quantity of which we had on deck, was all shifted forward so as to throw the stern as high out of the water as possible. The boat was then hauled ashore at high tide on the sand beach (the rise and fall of water is only from 18 to 24 inches), and then when the tide had ebbed the propeller was removed and the broken pieces of shaft carried ashore. A forge was the next necessary essential, and to construct that we borrowed, without permission, the water cask from the residence of the Anglican priest here. He is absent in England, and his water cask, in which rain water for drinking is collected, is the only one on the island, and consequently was our only hope. On Mr. Waring's suggestions and designs, the heads were removed, a center partition with a valve was inserted, bellows ends made from canvas and wood were put on, the cask was set over a hole in the sand, the lever working on the under end, and the forge was constructed. Luckily the island is of coral formation, so we had plenty of lime to build with. Our coal proved to be possessed of admirable blacksmith qualities and the blast from the bellows was as powerful, steady and in all ways as efficient as could be desired and as good as any that could have been secured in St. John. The broken pieces were welded, the shaft straightened and trimmed, and, in fact, as good a job made as could have been turned out by any machine shop. Our anvil was formed from a very heavy block of wood and a large piece of iron which belonged to an Eastport brigantine, the "Daisy Boynton," which was wrecked here two or three years ago. With regard to the minister's water barrel the heads will be replaced and the whole returned in as good condition as before. I forgot to say that luckily we had on board a 24-pound sledge hammer, which was of great value in the welding of our shaft, which was over 17 feet in length, was of steel and 3½ inches in diameter. Such repairs to an iron shaft would not have been wonderful, but we consider that to a steel one, under such conditions, almost a miracle has been accomplished.

A Reminiscence.

George Escol Sellers is writing a very interesting series of articles in the AMERICAN MACHINIST about his early engineering experiences; in the latest of these articles we find this paragraph:

"It was the result of my experience with the hammer that led me to design my locomotive for overcoming heavy grades by means of auxiliary steam cylinders operating horizontal wheels that gripped a central rail, the force of the grip being regulated by the weight of the train being drawn. I do not now propose to say anything of the labor, care and anxiety that invention caused me. It is too unending a net to get into."

We hope Mr. Sellers will not take it amiss if we supply a few details. He had a small locomotive of about two feet gage, possibly one ton in weight, that ran on a railway in 1848 (?) in a vacant lot in this city, Nineteenth street between Fourth and Lexington avenues. At one end of the railway was a very short steep grade; as recalled it was at an angle of about 30 degrees with the horizon. The engine had a small platform car attached and the load was all the boys in the neighborhood. The present writer happened to be one of them. The engine performed all that was expected of it, apparently, though Mr. Sellers dismisses it with a very brief mention.—*The Engineer.*

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Cast-Iron.

Amid all the whirling changes of the times, especially in the engineering world, cast-iron is still cast-iron and still the dominant element in machine construction, with apparently every prospect of unbroken continuance of employment. This stability and permanence in the midst of the sweeping tide of progress is only a manifestation of the sterling qualities of the material. It is pre-eminently conservative and reliable, and nothing could be more characteristic than its staying quality.

Cast-iron is young yet as the world goes, and it is too early to be thinking of the day when it shall be superannuated. With cast-iron the ancients were practically unacquainted. Of all the samples of iron in existence that may be called ancient not one is cast-iron. They are all malleable and have been shaped by hammering. The oldest piece of iron known to be in existence today is supposed to date about 3,000 B. C., while cast-iron only began to be known and used about the beginning of the last century. James Watt gave cast-iron its great start in life, just as he unknowingly gave added value to all material things. As only a few years ago Holly could say that the evolution of Bessemer steel was as much an achievement of the engineer as of the chemist, so cast-iron was only lifted to the full dignity of its position by the hand that could compel the mightiest forces of nature to do its bidding.

Two properties combine to give cast-iron its value and usefulness to man—its strength, especially as a bearer of burdens or in resistance to crushing loads, and its ready adaptability to the shape of any mold that man may fashion for it to run into. There is no laborious shaping of a solid mass of metal as the statue is cut from the block of stone. Cast-iron is now so familiar to us all that nothing can possibly be called wonderful about it, yet how otherwise than wonderful may we characterize the fact that the most plastic and shapable and the most unstable of material things, the shifting sand, makes the mold into which man pours the liquid iron, and in an hour it is fixed for all time, a type of what is most strong and enduring. The sands are the playthings of the waves yet the flow of the molten iron does not disturb the most delicate shaping of it, and every intricacy and convolution is reproduced in the solid metal.

There are in these days those who would discredit and belittle cast-iron, but they should know what they are at. If cast-iron is not to be trusted where, indeed are we safe. What is called treachery and unreliability in cast-iron is in fact only its honesty and a proof of its reliability. Its weakness, if we may call it so, is to its credit. It promptly repudiates the task to which it is not adapted, and snaps at once if its load is improperly applied. You may push it and pile your weight upon it, but you may not pull it with impunity. The recent collapse of a building nearing completion in this city where cast-iron columns and steel beams were used for all the interior work showed indisputably that the fault was not due to the material but to defective foundations. The columns used in the building were many of them imperfect castings, with numerous blow holes and eccentric cores, showing that the old standards of inspection, even if honestly and thoroughly applied, are inadequate and often entirely inapplicable to the modern and advanced methods and materials of construction. The only danger in the use of cast-iron for structural purposes is from imperfect castings, and imperfect castings may be detected by competent inspection and testing.

The use of cast-iron for fly wheels is evidently wrong, especially for high speeds, or for situations where high speeds may be possible at times from the racing of steam engines or similar conditions. The temptation to use cast-iron for fly wheels is great and likely to continue, although it is diminishing, especially in view of the frequent failures of such wheels. Methods are advancing for the construction of wheels with rims and arms of steel that must be much safer and more reliable. A rim entirely of wire would seem to be the ideal for strength, but it must always be a costly style of construction. Why not make the rim of a fly wheel of a continuous plate of steel, the plate rolled in as long strips as possible, and of a width equal to the thickness of the required rim, and then wound spirally until the required weight of rim was secured? The successive lengths of plate might be electrically welded, and the entire rim might be wound up without a hole to weaken it. Straps around the outside of the rim could keep it in place and secure it to the arms, which, of course, should also be of steel. For the hub we would still be under obligations to cast iron.

The ideal wearing surface is the unwearing surface, and for rubbing or sliding surfaces cast-iron is still one of the best materials known, if not the best. Its adaptability for slides and journal bearings is probably largely an expression of its ability to withstand crushing. It is also unique among the metals in that it works well upon itself. The interior surface of a steam cylinder in which a piston with cast-iron packing has traveled thousands of miles back and forth is a wonderful and mechanically beautiful sight. Engines are still in use upon the steamboats of the Hudson that have outlived two or three hulls each. The old steamboat engines have in fact lived much too long, for the improvements in steam-engine practice have left them far behind in economy. On the great racing steamships of the Atlantic the pistons each traverse the cylinders nearly half as many miles as the ship makes through the water, yet no one ever heard of a steam cylinder being discarded because it was worn out. Cast-iron journals are largely used for small spindles and with wonderful success. Sewing machines have run for a quarter of a century with little appreciable wear. Careful lubrication at the beginning and a little reliable lubrication all the while in connection with cast-iron bearings gives wonderful longevity. It is doubtful if the possibilities of cast-iron as anti-friction metal are to this day appreciated. Taken all in all we would hesitate long to set any material used by the engineer, either for what it has done or for what it still may do, above cast-iron.

A Series of Articles on Bicycle Manufacturing.

Next week we shall commence the publication of a series of articles in which the manufacture of bicycles as carried on in this country will be fully illustrated and described. The articles are written by a competent mechanic, well informed in such matters, and the general plan will be to take each piece of the bicycle separately and show how it is produced in a number of different shops, thus enabling the various methods to be readily compared, and their relative advantages seen. This, it is thought, will make the articles much more useful to the student of manufacturing processes than they would be if each factory were treated separately.

The manufacture of bicycles is one of the important American industries, and is, just at this time, among the most prominent of the machine-producing industries.

Not only those who are directly engaged in the work of producing bicycles, but all who are much interested in machinery, or in machine manufacturing processes, will find much in this series of articles to interest and help them. The articles will be as complete as possible, will be profusely illustrated, and will be adapted especially to the practical men who in one capacity or another have the various problems connected with manufacturing operations to solve. So far as possible an article will appear each week until the series is finished, and they will probably run through several months, though generally each installment will be complete in itself.

There is, of course, no doubt that if every mechanic engaged in bicycle production could travel about the country and visit nearly or quite all the leading shops to study their methods, the result would be very beneficial both to the mechanics and to their employers. Few, if any, can do this, but they can derive nearly if not quite as much benefit from these articles, which will set forth by text and illustration much more than the average man would be able to see in going through the same shops.

Recent tests of the Nantasket Beach electric traction equipment (of which we gave an account in our issue of July 25th), together with the results of the summer's work with it, indicate that such a plant is well adapted to the conditions, and that similar ones will be used in other places where conditions are similar. This, so far as we can see, is about all that can be said for it at this time, notwithstanding the extravagant claims that have been made, and the predictions to the effect that this plant and its performance indicate that a general change is coming in matters of transportation. Perhaps such a change is really coming, but the proof that it is coming is as yet lacking.

It is said that experience is showing that the locomotives used in the tunnel under the Detroit River at Port Huron, on the Grand Trunk Railroad, discharge so much steam and highly heated gases against the steel lining of the tunnel that the effect is very injurious to the species of asphalt which has been filled in outside between the casing and the rock through which the tunnel was bored. It is thought that electric motors may on this account be substituted.

In commenting last week on "Scientific Tempering" we were somehow made to put the variation in temperature between various pieces at 20 degrees, whereas it was really 40 degrees, as stated by Mr. Simonds.

Literary Notes.

We have received a copy of the twenty-eighth annual number of "Poor's Manual of the Railroads of the United States for 1895." The information presented is arranged in two sections—the first comprising the statements of all steam railroads in the United States and Canada, and the chief ones in Mexico; next the statements of the street railway and traction companies in the chief cities of the United States, followed by statements of leading industrial corporations and organizations auxiliary to the railway interest.

It is published by H. V. and H. W. Poor, 44 Broad street, New York.

We have received the first number of the *Stationary Engineers' Gazetteer*, of Illinois. This is mainly a list of engineers in charge of steam plants within the State named, and gives the leading particulars regarding the plants. It is published by an association of working engineers, and is believed to be very complete. It is almost entirely commercial in its character, of course, and will prove valuable as a reference or directory. We understand that it is to be revised and re-issued every year, and it is published by the Stationary Engineers' Gazetteer Association, 159 La Salle street, Chicago.

The Morning Herald, of Baltimore, is offering special terms on a new edition of the "Encyclopedia Britannica," and in connection with this supplies a "Guide to Systematic Readings in the Encyclopedia Britannica," which has been prepared by James Baldwin, Ph. D., author of "The Book Lover," etc. This book ought to prove a great help in deriving the most possible benefit from the great work to which it relates, since it is so classified and arranged that persons engaged in almost any pursuit, or having almost any particular taste or inclination can readily select a complete and systematic course of reading.

For instance, Chapter XXVII. of the guide is devoted to "The Machinist," and in it is set forth a list of articles and parts of articles that will be specially valuable for practical men who wish to study machinery and the principles of machine construction,

arranged in progressive order. There is also a chapter devoted to "The Engineer." The guide contains 312 pages and a good index, and is bound in cloth and leather. Those who have or intend to get the "Encyclopedia Britannica" will do well to write the *Herald* for particulars.

QUESTIONS AND ANSWERS.

Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet. We cannot undertake to answer questions in "next issue." This department is usually crowded, and questions must wait their turn to be answered. Neither can we undertake to solve mechanical or engineering problems, and send answers by mail.

(351) Worm Gear, Schenectady, N. Y., asks: Are there any machines for the correct cutting of worm gears, or must the gears be finished with a hob? If the former, could you name a maker? *A.*—A good deal depends upon what is understood by the term "correct cutting." If the worm gear is to do very light work, it may be cut by a rotary diagonally across the face, the face of the wheel in this case being flat, the same as that of a spur gear. Such worm wheels are used for some purposes and work well; but if you desire the teeth of the worm and wheel to have the greatest possible amount of working contact, then the only practicable method of finishing is by the use of a hob.

(352) B. F., Des Moines, Ia., asks: Are the papers on drafting still to be had from your office? *A.*—Yes. Selected papers making a complete set can be obtained or they may be had as part of the volumes for the years 1886-7-8-9. 2. Suppose we have a pair of bevel gears correctly made working on shafts at right angles. The pitch diameter of one is 3 inches, the other 9 inches. Is it practically possible to make a gear of 7 inches pitch diameter that will also work in the pinion? *A.*—Probably not without some modification of the pinion. Bevel gears made upon this plan were shown at Chicago by Hugo Bilgram, and the principles of their construction are illustrated and described in our issue of October 12, 1893.

(353) E. H. L., Brooklyn, N. Y., asks: Has "Trautwine's Engineer's Pocket-Book" ever been revised? If so, who are the publishers of the latest edition? *A.*—It has been revised, and is now published by John Wiley & Sons, 53 East Tenth street, New York. 2. Is the International Correspondence School, Scranton, Pa., what it is represented to be? *A.*—We believe so. 3. In "Rankine's Machinery and Mill Work," on page 586, the millimeter is given as .03937043 inch, British measure, while "Wood's Elementary Mechanics" gives .03937079 inch for the millimeter. Other works give the same value as Professor Wood. It seems to be a mistake in Rankine's, is it not? *A.*—We cannot call this difference in length a mistake, since the standard bars from which the lengths are taken differ to a slight degree. The difference of the millimeter here mentioned is so small that it cannot be detected by the ordinary means of measurement, and will not affect the finest measurements in practice. 4. Which is the best work on the calculus for self-instruction? *A.*—We do not know which is the best work treating on this subject, however, we prefer Smyth's calculus.

(354) A. D., New York, writes: I have built a steam launch from the plans by Henry J. Gielow, published in the AMERICAN MACHINIST. I launched the boat on the 17th July last. On taking the boat out of the water last week I was surprised to find the shaft, 1¼ inches diameter, corroded to ⅞ inch diameter between the wheel and the stern bearing, and also found that the heads of the galvanized lag screws, which fasten the stern bearing, completely gone. The wheel and bearing are of composition. There is also a lead sleeve in stern dead wood. I think the trouble is caused by galvanic action. Please let me know if you think that I am right, and how to remedy it, when I put in a new shaft in the spring, and also, if I can use any other metal for the shaft. *A.*—You give the correct cause for the corrosion, in fact, nothing else could have been expected, when steel and brass are in contact with salt water. The lag screws should be made of Muntz's metal or forged Tobin bronze. The part of the shaft which passes through the stern bearing should have a brass sleeve. But it will be as cheap and better in the end to make this part of the shaft of Tobin bronze, which will need no sleeve.

(355) E. M. C., ——, N. H., writes: We are having much trouble with our bronze. We use largely old bronze supposed to be about 1 tin to 16 copper, with the addition of a very little phosphorus. Nearly all our castings are full of small clean holes, sometimes the castings are perfectly honeycombed. We have tried the old metal alone and with various proportions of new metal; we have added tin, copper and lead in various proportions and combinations, and have poured hot and cold, in green sand molds and dry ones, and always with the same result. The castings have been all the way from fairly good to worthless, but never perfect. If you can suggest anything that will help us out of this difficulty, you will greatly oblige us. *A.*—The old metal should never be used alone, not more than ½ of a mixture should be old metal. An alloy of 1 tin to 16 copper, without a trace of lead or zinc in it, is very difficult to pour; an addition of 1 per cent. of lead and 1 per cent. of zinc will be an improvement. Great care is required in melting phosphor bronze, and when it has the proper temperature for pouring, it should be used at once. Sand which is too fine, and wet molds will give imperfect results. To make perfect phospor-bronze castings requires considerable experience, and should only be attempted by experienced workmen.

(356) O. E. P., New York, writes: A horizontal forged steel lever fulcrumed, say, at a point *A*, has to stand a pressure of 2,500 pounds at its outer end *B*, the distance between *A* and *B* is 29 inches. If the thickness is 1 inch, what would you consider a safe depth for the lever at a distance of 27 inches from *B*? *A.*—The depth of the lever at a given point at any distance from the outer end *B* is found by the following formula:

$$\frac{6 \times l \times W}{S \times b} = d^2,$$

in which l = distance in inches from the outer end *B* of lever to the section at which the depth is to be found; in this case it is 27 inches. W = the load in pounds supported at the end *B*, b = thickness in inches of the lever, d = breadth in inches, and S = safe working tensile strength per square inch on the outer fibers of the lever; for steel of a good quality we may take a value of 20,000 pounds for *S*. Substituting for the letters in the above formula their values, we have,

$$\frac{6 \times 27 \times 2{,}500}{20{,}000 \times 1} = d^2 = 20.25,$$

the square root of 20.25 is 4½ inches, which is the required depth at 27 inches from the outer end *B*. In the same way we can find the depth at any part of the lever, taking care to substitute the correct value for the length l given in the formula. When the thickness of the lever is uniform throughout, and the depth at different distances determined by the above formula, the profile of the lever is that of a parabola whose vertex is at the load. In practice the profile consists generally of straight lines; under these conditions the depth at *B* should be equal to one half the depth at *A*. With a drawing of such a lever, the depth at any part can at once be obtained by direct measurement. The depth at *A* is computed by same formula, provided the thickness of the lever at *A* is increased to compensate for the hole bored through it to receive the fulcrum pin.

(357) W., Lynn, Mass., writes: Given two engines of the same rated horse-power, one a first class high-speed engine and the other of the Corliss type, each of about 60 horse-power, and connected to the same boiler so that conditions shall be the same. Which engine will develop the greatest indicated horse-power for equal pounds of water evaporated? 2. Which will deliver the greatest power to a shaft directly coupled to the engine shaft for equal pounds of water evaporated? *A.*—The questions remind us of an Irish fireman who used to come with the statement that he "wanted to ask a d——d small question," and would follow with a problem in metaphysics which would make an all-night job for a skilled professor in that abstruse science. These questions are susceptible of various interpretations, depending on the respective ratings given by the builders, and the boiler pressure carried. In neither question is economy at the rated power considered. If this is intentional, it is probable that the questioner wishes to know which engine will deliver the greatest power, at a given cost in steam, regardless of what either engine was designed to do by its builder—a condition under which steam engines are rarely, if ever, run. The high speed engine is amenable to its governor at all points in its stroke; the steam may be carried to ⅜ or ¼ cut-off, and still be within good regulation. At these later cut-offs, the large clearance in this type of engine is less wasteful for the reason that it is drawn from a large volume of working steam. The Corliss engine, while more economical under fair conditions, on account of small clearance, will not respond to its governor unless the cut-off takes place before ½ stroke. This feature limits the maximum load in this type of engine to considerable less than the maximum in the short-stroke engine. If the piston speed of the two engines be alike, the Corliss may be run without releasing, and thus carry steam full stroke and give quite as much power as the high-speed engine; but under such conditions would not be as economical as the high-speed engine. The Corliss engine would deliver its maximum load, under control of governor, at a less cost in steam per horse-power than the high-speed would deliver its maximum, but the high-speed would deliver a greater power. The answer to the second question is determined by the relative friction of the two engines. Assuming the frictional resistance to be the same, the results in the two cases would be alike. It is probable with each engine well built and set, there would be but little difference in friction. Another answer we might give to these questions, which answer would be equally true and fully as satisfactory, perhaps, is: We don't know. The fact is, that the question is indeterminate and cannot be answered categorically. If two such engines were tried under such circumstances and their water consumption and brake horse-power measured, we should know something of that particular case, but any change in either engine or in any condition would make a new trial necessary.

(358) J. P. M., Jacksonville, Fla., writes: Of late I have had some trouble in casting a thin elliptical plate and getting it flat when cooled. As shown in the sketch, the plate is 4 feet by 3 feet 3 inches and $\frac{5}{16}$ inch thick. When I first tried it the ribs were as in Fig. 1; then they were altered, as in Fig. 2, but the result was the same. The plate would work and be convex on the side where the ribs were, the curvature extending diagonally, or from *A* to *B*. When cast, the flask was heavily weighted, and remained so till perfectly cool. At another time the plate was removed from the mold as quickly as possible, but neither way did

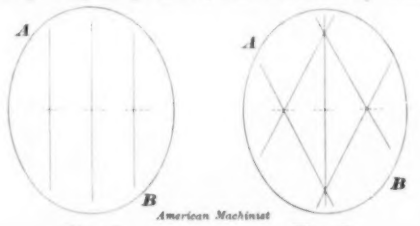

Fig. 1 *Fig. 2*

any good. The ribs on the plate were ¼ inch thick and 2 inches deep at the middle, tapering to ½ inch at the ends, and were beveled to a fine edge along the top for a distance of 18 inches from the ends. There is an oblong hole ⅝ inch by 1 inch through the ribs, as shown by the dotted lines. The plate is for a damper in a smoke stack. *A.*—We referred this case to Mr. L. C. Jewett, who writes as follows: The elliptical plate, $\frac{5}{16}$ inch thick, with ribs ½ inch thick and 2 inches deep, is sadly out of proportion. The ribs should not be more than one and one-half times as thick as the plate, or, say, $\frac{9}{32}$ inch. In molding a plate like this a good strong bottom board is needed with stiff battens. Good bearing on the sand for the battens or cleets is as essential as the weighting of the cope and wedging of the bars to prevent the cope lifting, as the pressure is of course equal in every direction, and with every care the thickness of the casting will exceed the pattern, both in the plate and in the ribs. The best practice to keep such a casting straight, or comparatively so, is to have ready arrangements for turning the whole flask over as soon as it is poured, and while clamped up. Turn on to a deep soft level bed of sand, knock off the clamps, remove the bottom board and scrape away the sand from the ribs to within 6 or 8 inches of the ends. Scrape the sand off through the middle even down to the plate. It cannot be done too quickly, as the plate will solidify in less than 30 seconds, and contraction commences and goes on rapidly. It might be possible to knock the sand out of the cope on top of the casting and dig out the sand under the plate between the ribs, thus exposing them to the air and cooling them down to keep pace, as it were, with the rapidly cooling plate, and thus keep the plate straight, but by turning the flask over you can see what you are doing much better. The reason why castings warp and twist is owing to some portion of the casting being thicker or broader, or so situated in the mold that in cooling it is the last to do so. The last portion to lose its heat has the last pull, and ofttimes a strong pull it is. Everyone knows that extremities give off heat quickest and first, consequently the thing to try to do is to so expose the surfaces, or cover them as the necessities require, to the end, that all parts will cool in unison; it sometimes becomes necessary to pour hot iron on or around some thin or light portion of a casting to supply or reinforce it with heat, so that it does not cool in advance of the other portions.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Gear Wheels, Gear Cutting. Grant; see page 772.

Forming Lathes, Mer. Mach. Tool Co., Meriden, Ct.

Milling Machs. Kempsmith Co., Milwaukee, Wis.

Patent Solicitor. J. G. D. Mack, Madison, Wis

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt St., N.Y.

Best Presses and Dies for all sheet metal work, Ferracute Machine Company, Bridgeton, N. J.

Just issued—Catalog No. 8. Mailed Free. Clayton Air Compressor Works, 28 Cortlandt St., New York.

Marine Iron Works, Chicago, builders of steam yachts and marine machinery; catalogs free.

Squaring and Rotary Shears, Tinsmiths' Tools, Presses and Dies for sheet metal work, are made by the Niagara Stamping and Tool Co., Buffalo, N.Y.

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Three valuable books by Prof. N. Hawkins—"Calculations," $2.50; "Instructions for the Boiler Room," $2.50; "Aids to Engineers' Examinations," $2. Sold on installments. Write for terms and catalog. Theo. Audel & Co., 91 Liberty St., N. Y.

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I keep in stock brass pattern letters and numbers, with spurs on the back to hold them on. They never drop off. Same price as lead letters. Write for sample, free. Twining Campbell, Brass and Aluminum Founder, Paterson, N. J.

The Phonograph and the Pump.

It can scarcely be doubted that the phonograph, although its status at present is little more than that of a toy, and its sole function that of amusement, is capable of rendering very valuable service, and of the most practical kind, in connection with the running of steam engines or machinery. When we realize how important the ear is in the supervision of all running machinery, and how much may be learned of the action of inaccessible parts by careful listening, the applicability of the phonograph is at once apparent. As the physician learns of the action of the heart and the lungs in the human organism and makes his diagnosis, so the engineer listens for the motion of the valves, the flow of steam or water, or the action of rods and connections, and makes his adjustments, often most successfully, under such guidance. One would almost as soon think of riding behind a blind locomotive engineer as after a deaf one. Few probably realize how keen the sense of hearing often becomes among engineers. To those unfamiliar with the sounds of the engine room or the cab, they seem to be all confusion, if not deafening, but to the engineer they speak differently, and he, perhaps generally unconsciously, immediately detects minute changes, either by the cessation or by the accession of individual sounds, just as the leader of an orchestra is cognizant of every false or missing note. An engineer whom we used to know, and who ran a regular passenger train upon an Eastern road, told, and we believed him, how he was once perplexed by a strange and unaccountable sound upon his engine. He had run the engine for some time, and his ear had learned completely the rhythm of it, when one day a little strange sound was detected, a false note, that while it lasted gave him no more peace. He began searching the engine in every part, and spent every moment when stops were made in examining his joints, and wherever there seemed to be a possibility of anything wrong. After a week of perplexity and worry continually approaching torture, he got another man to make a trip for him, and before this man got back he had found a loose nut upon the bell frame, and when that was tightened the strange sound disappeared, and the engineer could resume his running with a greatly relieved mind. A

proprietor who has had a machine business grow up around him, and whose office is in easy hearing of the machine shop, will often be quick to discover strange sounds marring its music, and will not be able to rest until he knows the cause of them. If sounds are so closely followed by accustomed ears, and if they can tell the owners of those ears so much, then the record or reproduction of those sounds must also possess power and significance, and may be made to convey at second hand the intelligence that might have been gathered from the original noises. There comes to us an account of a practical application of the phonograph, such as we may expect to find frequently repeated in the future. One of the pumps manufactured by the Knowles Pump Company was erected at the Elk River pumping station in California. The pump was in constant use for some years, giving satisfactory service when something began to go wrong with it, and no one around it was able to tell what was the matter. The services of the pump could not well be spared, so that it could not be stopped and taken apart, and it would have cost a large sum to bring an expert all the way from the East, so it was determined to resort to the use of the phonograph. The manager spoke into the receiver describing the symptoms of the ailing pump, and then, to further indicate the case, the receiver was placed so that the pulsations of the pump could be recorded on the roll. Thousands of miles away the pump doctor was able to listen to the strokes of the pump, and was able at once to determine the trouble. The engineer at the home office of the Knowles Pump Co. said that the whole record of the pump action was so perfect that he felt as if he was in the actual presence of the pump and its runner, and could ask any question direct.

The engineer of the future, then, may have a phonograph to carry in addition to the steam-engine indicator and his other familiar instruments.

Some Cheap Shop Hoists.

BY JAMES F. HOBART.

Probably the handiest shop hoist for unloading and loading from wagon or car, is an overhead traveler which projects out of doors over the main entrance to the shop (the main shipping entrance) and is actuated by power, either electric or mechanical. When this convenience is not at hand some excellent substitutes can be "home made" to answer the purpose. Fig. 1 shows a very cheap concern which is simply suspended outside, and above the door, and hangs a good deal like the old-fashioned fireplace crane from which the old-time "bean porridge" kettle used to hang about all the time.

This neat little crane is made of angle iron, as shown, and is presumably so scientifically curved that all the strength necessary is secured with a minimum of material. The mast is made of four pieces of angle iron, riveted and bolted together, as indicated in the engraving. Fig. 2 illustrates a section of the mast, showing construction of same, the sectioned space *e* representing a plate which is inserted at *d*, for the purpose of attaching the boom, which is made of two pieces of angle iron similar to those used in the mast. Other wrought or steel plates are also inserted at *e*, *f* and *g*. The one at *e* sustains the brace or "top chord" of the device. Plates *f* and *g* are extensions of the forgings forming the top and bottom bearings or pivots of the crane.

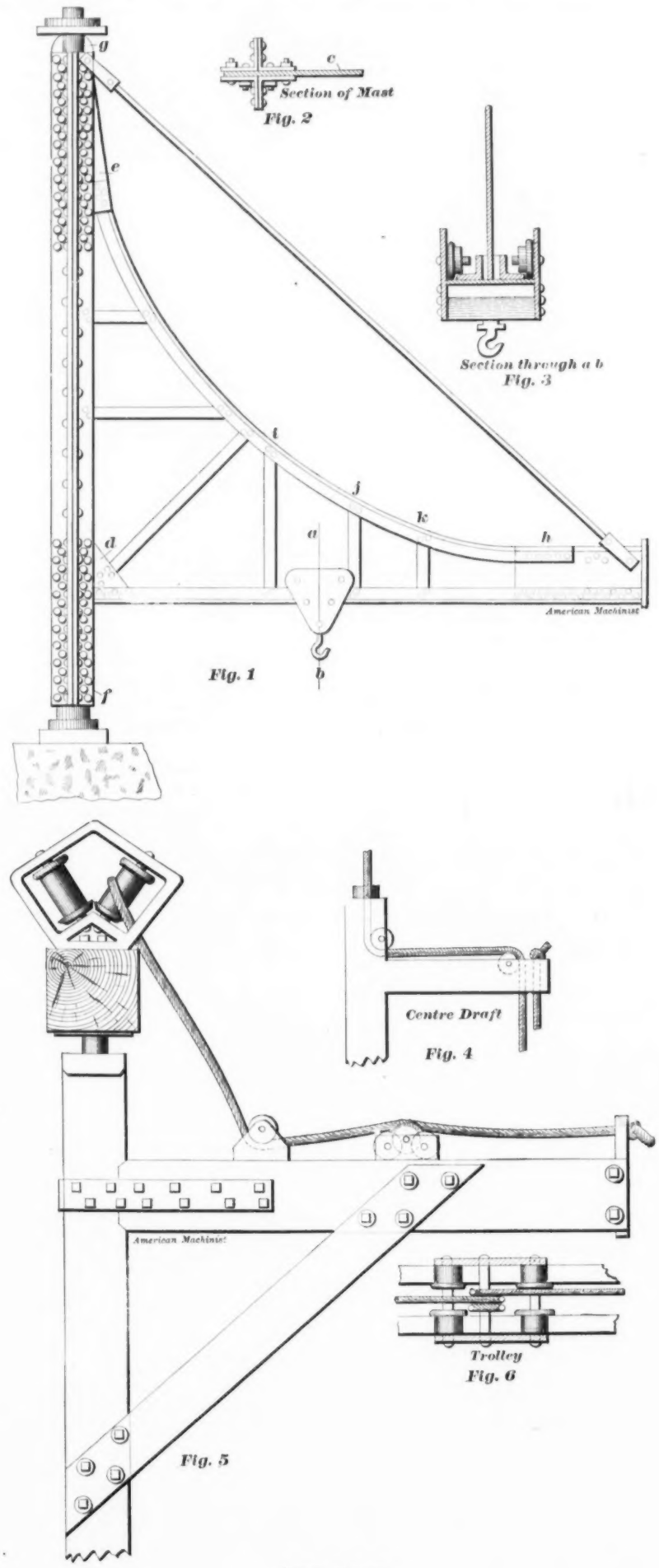
The boom is, as stated, made of two pieces of angle iron (presumably steel) separated by plates in the same manner that the mast is. This is shown in the section of boom, Fig. 3. The "trolley" which runs on the boom is also shown by this cut. It is an ordinary four-wheel device of the character usually employed for such purposes. No provision is made in this crane arrangement for the application of power, a set of differential tackle hung upon the hook, forming the entire hoisting power; probably sufficient for the small work for which this crane is intended, the whole affair being very light, the angle iron being only 3 inches wide and $\frac{3}{8}$ or $\frac{1}{2}$ inch thick.

By applying a trolley something like that shown by Figs. 5 and 6, but inverted, the hoisting rope could be carried to a power drum for heavier or quicker work.

Fig. 5 is an outside crane with a modification of the usual guide pulleys at the top. Fig. 4 shows the usual arrangement of a single guide sheave for the hoisting rope, but it is replaced in this construction by the form shown in Fig. 5, where two drum pulleys are used, instead of a single sheave. It will be noted that the axes of the rolls are not placed at 90 degrees, but make a somewhat greater angle, so that the tendency of the rope is to run *away* from, instead of *against* the bottom flanges.

The hoist is built of wood, both mast and boom being made in two pieces framed apart by distance blocks and castings at top and bottom, and top for pivot bearings. As shown in Fig. 5, the hoisting rope is made fast to an extension of the distance piece which is framed into the end of the boom. From there the rope passes over one sheave of the trolley, then down around the lifting (lower) block of the tackle thus formed.

There are three sheaves side by side in the trolley, and two in the block. The rope passes from the block to the *outer* sheave of the trolley, from which it goes again to the block, then back to the *middle* trolley sheave. This is done in order to give the hoisting rope as central a draft as possible. No provision is made for moving the trolley when the crane is loaded, the only use apparently made of it being to move the trolley back and forth with a pole, while it is unloaded, in order to allow the load to be lowered at any required length of radius from the mast.



SHOP HOISTS.

Handy as these devices will be found in small shops, one can hardly help contrasting them with the possibilities where an overhead traveler is used. Then, one of the beams or ledges carrying the traveler can be extended out of doors, being made as heavy as necessary, and projecting as far as desirable; then, a trolley is arranged to run on both the regular and the extension. Connection between the little trolley and the traveler is to be made by coupling in a connecting bar of the requisite length—long enough to reach out of doors over the wagon or car, or into a car.

It is only necessary to drop a coupling pin into the extension bar, hook on the trolley hoisting chain, and the business is ready for unloading or loading in the most approved manner. The trolley is held rigidly at the end of the extension bar, and raising or lowering done by running the drum of the traveler, while lateral movement is obtained in the usual manner by bodily moving the whole traveler.

The Revolver a Swiss Invention.

P. F. Wallotton-Aubert, a member of the Swiss Historical Society, has published at Lausanne a sketch of Vallorbes, which contains the following curious information:

"The first idea of a repeating pistol came to Vallorbes in the beginning of this century in the brains of Jean François Glardon. A member of a happily gifted family, and partly aided by his sons, this successful artisan succeeded in making a pistol which fired seven consecutive shots. This marvelous weapon was sent in 1814 to the Emperor of Russia, Alexander I. The Czar received it agreeably, since there came to Vallorbes from him, with diamonds set in a ring, the following letter addressed to 'François Glardon, artist':

"'His Majesty, the Emperor, having accepted with satisfaction the homage which you have paid to him of a newly invented weapon, orders that I transmit to you the ring inclosed in this package as a mark of his good wishes. His Imperial Majesty has been pleased to appreciate the sentiment which suggested this gift, aside from the skillfulness whereof this ingenious work is a proof. I am, Sir, your most humble, obedient servant.

'COUNT CAPO D'ISTRIA.'

"Lacking sufficient capital and absorbed by the necessities of his family, François Glardon could not exploit his discovery, and the only evidence of it is doubtless preserved in the Imperial Treasury at St. Petersburg."

A Lathe to be Given to Some Technical School.

The Lodge & Davis Machine Tool Co., of Cincinnati, Ohio, will, on March 1, 1896, give the nickel and gold plated "tool-room lathe," exhibited by them at Chicago, to the technical or mechanical school receiving before that date the greatest number of votes. Anyone interested in the development of technical and mechanical education is entitled to vote.

The lathe is said to have cost $1,550 to build, and the mechanical school that has most friends willing to take the trouble of voting will get it free of cost.

We have received from the Franklin Institute, Philadelphia, Pa., program for the winter and spring terms of the classes in mechanical drawing, etc. The winter term began September 17th, and the spring term will begin January 14th. Full particulars can be obtained by addressing Mr. H. L. Heyl, actuary.

Improved brakes are coming *slowly but surely*, and with the recent improvements made in all classes of brakes, it is to be expected that *a few years* will see the complete overthrow of the now common hand brake.—*Street Railway Review*.

Foundry of The Frank H. Clement Co.

This is a small, unpretentious, everyday foundry, making from three to five tons a day of general machinery castings. Being built on leased land, one of the chief considerations was cheapness of construction, and the main building and wings attached are therefore of wood, while the pattern storage building is of brick for greater protection against fire.

The molding floor is 58x80 feet, making room for 16 floors 10x25 feet, with 8 feet "mash" through center.

The cupola wing is 14x20 feet, two stories, and has a 1-ton stock elevator 5x6 feet, bins for clay, kaolin and limestone, and car track running through to receive fuel from one side and iron from the other. The charging room is provided with scales, and pockets are arranged for the different charges.

The cupola is 32 inches inside, 46 inches outside, Whiting pattern, with 14-inch air pipe and two sets of tuyeres. The stack is 33 feet high, and has a spark arrester.

A 5-ton steel hand crane with 20-foot boom, compound gearing and locking brake, swings from a point just inside the "mash;" the staying of the mast and the foundation pier are shown in the cross section, Fig. 5.

A car track runs entirely through the foundry and cleaning room to the flask shed at one end, and to the machine shop at the other.

For fire protection the inside of the molding room is lined for 4 feet from the grade with corrugated sheet-iron, No. 28 gage, nailed to the sheathing with asbestos paper between, and at the base, lapping upon the sheet-iron and resting upon the foundation wall, there is a fillet of concrete extending entirely around the room, thus preventing any exposure of the woodwork to hot iron or ignited flasks.

There are 24 windows 3x9 feet in the side walls, three swinging sashes in each gable, and four large dormer windows with hinged sashes for ventilation, each 20 feet long.

The core shop wing contains also sand bins, mixing bin and sand sifter; sand is unloaded from wagons, which may be driven through the flask shed, under doors in each bin.

The motor room is partitioned off from the cleaning-room wing, and contains 15 horse-power electric motor, No. 4 Baker blower, lockers for 30 employes, foreman's desk and wash tray. A store room, 8x24 feet, accommodates facings, chaplets, brushes and necessary supplies.

The cleaning room is 34x24 feet, and contains three tumbling mills of different sizes, with space for two more for small work, one double emery grinder with 16-inch wheels, bench with three vises, vitriol trough, and a 3-ton track scales.

The core shop is provided with suitable benches and shelving, and a trolley rail and hoist for handling heavy cores and plates. The core oven is shown in Figs. 6 and 7, and is built on stone foundation 3 feet 6 inches below grade; it is 7 feet 6 inches by 10 feet 7 inches high; the walls are 8 inches thick and the roof is composed of brick arches resting on steel I-beams 6 inches deep. The chimney has two dampers, one at top and one at bottom of oven, with rods extending outside to work them. The fire grate is 18x30 inches, and the fire box is grated at the back, so that the products of combustion mostly go directly into the oven at the bottom under the car.

The car is 4x8 feet with roller bearings, and four shelves to receive cores, three of which are removable.

At the side of the oven next the core room there are three shelves arranged on brackets, to which access is had by three iron doors. Small cores are baked on these shelves, and they may be put in or removed without disturbing the car or opening the main door.

Coke is used exclusively in the furnace.

This oven is found to work in practice very satisfactorily, being under perfect control and accessible at all times, and economical in the use of fuel; the design we believe is original.

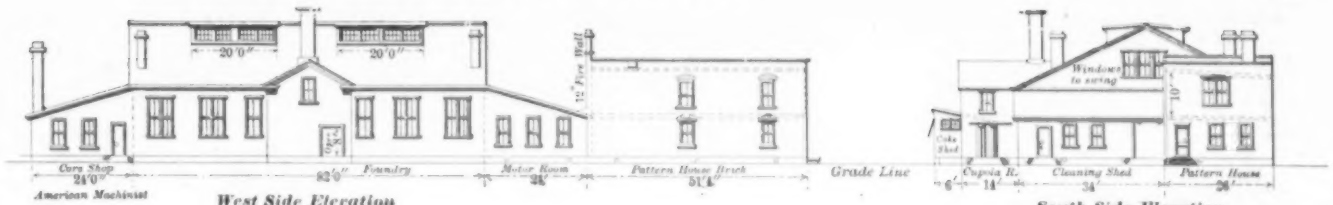


Fig. 1 Fig. 2

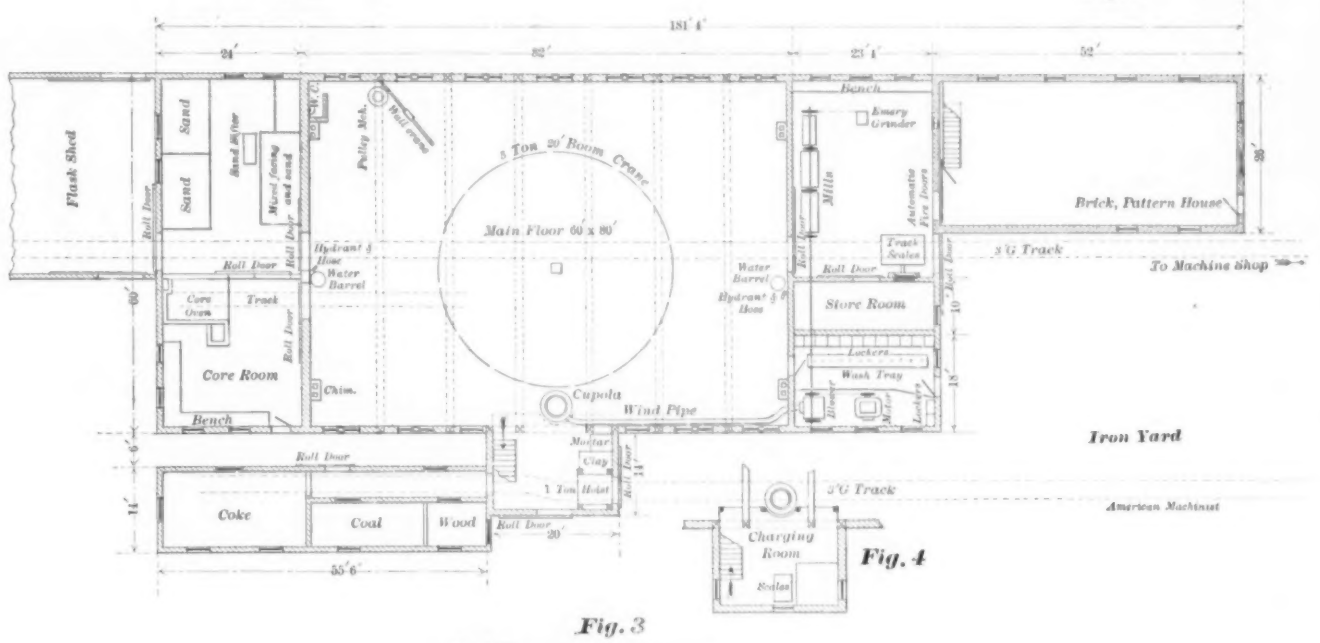


Fig. 3 Fig. 4

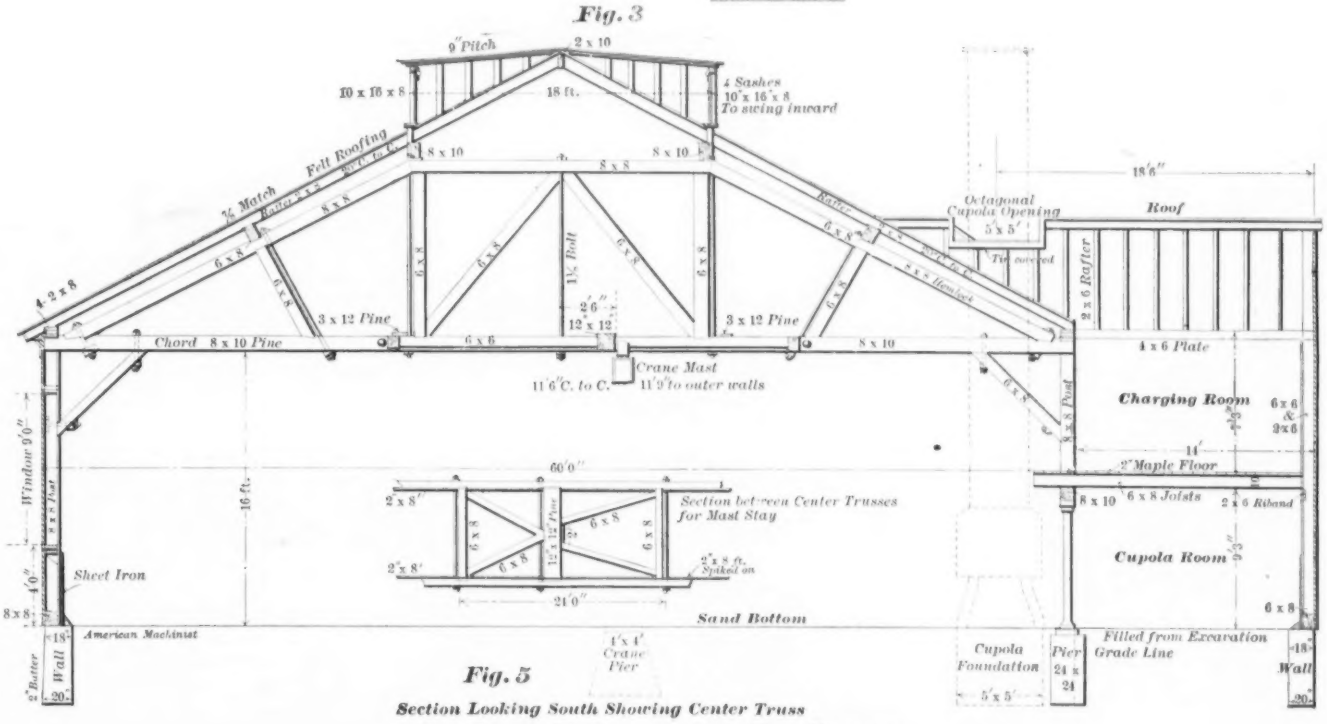


Fig. 5

Section Looking South Showing Center Truss

THE FRANK H. CLEMENT CO.'S NEW FOUNDRY.

The proprietors say that after two months use of this foundry and appurtenances, they see no change which would be desirable; no doubt improvements will suggest themselves, and some additions to the apparatus, such as air hoists, power attachment to crane, cinder mill near cupola, etc., might be useful; but the general arrangement of the various rooms and facilities for reaching and handling stock, fuel and finished product, are certainly very convenient, and much in advance of many foundries now in use. The plans for the whole, together with the core oven and other appurtenances, were made by Mr. F. H. Clement, president of the company, which builds woodworking machinery at Rochester, N. Y.

A Distinction.

Many of our friends and customers have undoubtedly noticed the assignment of E. & B. Holmes, lately carrying on the lumber and planing-mill business at Buffalo, N. Y., and from the similarity of names may have concluded that our company was involved in the failure. We would esteem it a great favor if you would say to our many friends and patrons, through your valuable columns, that E. & B. Holmes Machinery Company, manufacturers of woodworking and barrel machinery, is a distinct corporation, and no way connected with the firm of E. & B. Holmes. E. & B. HOLMES MACH. CO.

Buffalo, N. Y.

On October 1st the classes in mechanics, drawing, etc., of the Young Men's Institute, at 222 Bowery, New York City, will be resumed. The fees charged for instruction are nominal, and the institute is doing excellent work in its way.

NEW CATALOGS.

There are three sizes of Standard Catalogs, 9" × 12", 6" × 9" and 4½" × 6". We recommend the 6" × 9" size for machinery catalogs. When they must be larger or smaller, one of the other standard sizes should be adopted if possible.

Julius Hanse, Buffalo, N. Y., sends us a small pamphlet illustrating and describing various tools of precision and measuring instruments, manufactured and sold by him. These include surface gages, micrometer calipers, etc., and the pamphlet is sent to those interested on application.

We have received from The Dwight Slate Mach. Co., Hartford, Conn., a catalog illustrating and describing various machine and small tools, most of which are specially adapted to manufacturing operations. It will be found interesting and useful and is sent to those interested on application. It is 4"x6¼".

The Ames Iron Works, Oswego, N. Y, have issued an elegant catalog, illustrating and describing their single cylinder automatic engines. Fine engravings with descriptive text, table of sizes and horse-power are included, and the catalog will be found of interest to all who have to do with steam plants. It is sent to those interested on application, and is standard size, 6"x9".

E. Lonergan & Co., 211 Race street, Philadelphia, Pa., send us a finely gotten up catalog of specialties manufactured by them, which consist of sight feed oilers and lubricators, various forms of valves,

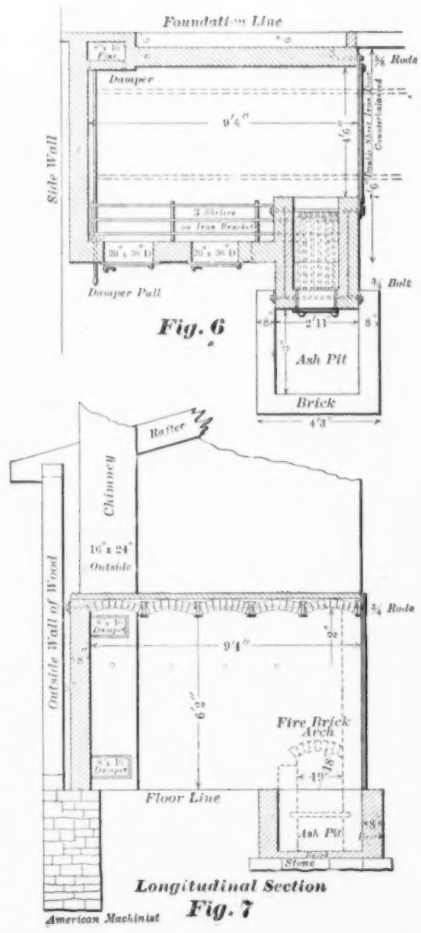


Fig. 6 Fig. 7

chime whistles, steam traps, and other safety steam appliances. Illustrations and full particulars are given, and the catalog is sent to those interesfed on application. It is bound in cloth, and is 9½"x6".

MANUFACTURES

The Post Falls Woollen Mill Co., of Spokane, Wash., has been formed with a capital of $10,000. Eugene Danzel is interested.

The Davey Pegging Machine Co. has been organized at Portland, Me., with a capital of $200,000. Wallace F. Robinson is president.

The New Jersey Automatic Fuel Generator and Burner Co., of Jersey City, N. J., has been incorporated by W. C. Mainland and Ira S. Elkins, with $100,000 capital.

The Quast Gas Engine Co., of Strasburg, Ill., has recently been incorporated by G. W. Gwin, Chas. Quast and others, with a capital of $50,000.

The Scott Gas Regulator Co., of New York City, has been incorporated, with $25,000 capital, by John H. Jenks and Walter G. Scott, of New York City, and Jos. A. Skeppestedt, of Brooklyn, N. Y.

It is understood that the Yale & Towne Mfg. Co., of Stamford, Conn., will this season go into the manufacture of bicycles on an extensive scale, and that they will make a strictly high-grade machine.

The Quast Gas and Gasoline Engine Co., Bucyrus, Ohio, has been dissolved, and Mr. Chas. Quast has organized a new company, to be called the Quast Gas Engine Co., at Strasburg, Ill. They will equip a machine shop and foundry with new machinery.

The Ulster County Electric Railroad Company, of Kingston, N. Y., has been organized to construct street surface railroad to be operated by electricity, with a capital of $100,000. The directors are: Chas. A. Johnson, F. H. Reed, Geo. N. McKibbin, Wm. C. Orton, Robt. McA. Lloyd, Chas. M. Nichols, R. C. Johnson and H. C. Evans, all of New York City, and Wm. T. Tiers, of Philadelphia, Pa.

The New Era Iron Works, of Dayton, Ohio, manufacturers of gas engines from 3 to 40 horsepower, are working night and day on orders, and during the past month have declined orders for 10 or 12 engines on account of not being able to deliver them. The natural consequence of this increased business is the addition of new machinery, which they have just ordered from the Lodge & Davis Machine Tool Co., of Cincinnati, Ohio.

The Hendey Machine Co. recently shipped a Hendey-Norton lathe and accessories to Iquique, Chili, the purchaser mentioning that he had become acquainted with the lathe through the AMERICAN MACHINIST. The Hendey Company, referring to the matter, say: "While all sales cannot be traced as clearly as this one was, we have no doubt that the AMERICAN MACHINIST is an agent which influences much of our export trade. Many of our inquiries for tools refer to it, though sales are usually made through our foreign agents."

The Tabor Mfg. Co., makers of foundry molding machines, of which we have given some account in former issues, has been reorganized, the firm of Manning, Maxwell & Moore having disposed of its interests in the company to Messrs. Harris Tabor, Angus Sinclair and E. H. Mumford, who are now president, vice-president, and treasurer and secretary respectively. The New York office of the company has been removed to Room 124, No. 39 Cortlandt street, New York. The machines will be built as heretofore, at the shops of Sam'l L. Moore & Sons, Elizabeth, N. J.

Machinists' Supplies and Iron.

NEW YORK, September 21, 1895.

Iron—American Pig—We quote standard Northern brands, $14 for No. 1; $13 for No. 2; $12.75 for No. 2 Plain, and $12.50 for Gray Forge. Southern brands, $14 for No. 1; $13.50 to $13.75 for No. 2; $13 to $13.50 for No. 3; $13.50 to $14 for No. 1 soft; $13 to $13.50 for No. 2 soft; and Foundry No. 4, $12.50 to $12.75.

Antimony—Business is fair, and prices are steady Cookson's is quoted at 8c. to 8¼c.; Hallett's, 7¼c. to 7¾c.; Japanese, 7c.

Lard Oil—Prime City is quoted at 50c. to 51c.

Copper—The demand has fallen off and prices have a lower tendency; although it is reported that mining companies are not offering Lake Copper at less than 12.25c., outside lots are quoted at 12.15c. Casting Copper can be had to a limited extent at 11½c.

Lead—The market is weak, and prices have slightly declined. Carload lots of Common Domestic can be bought at 3.35c., and larger quantities may probably be obtained for a shade less. Bids run generally about 3.30c.

Spelter—Business has been fair and prices have stiffened; 4.35c. to 4.40c., according to quality, seem to be the inside quotations.

Tin—Business with consumers has been very fair. Quotations range from 14.35c. to 14.40c. net cash for round lots, current month delivery.

In the next issue of the

AMERICAN MACHINIST

we shall commence the publication of a series of splendidly illustrated articles, which will tell how bicycles are manufactured in this country. The writer is a mechanic, versed in the matters of which he writes, and the series will be one of the most interesting and useful ever presented in these columns.

If you are not a subscriber you should become one, and you should send for our very liberal terms to club raisers.

There is "Something in It."

WANTED

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. The Cash and Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

TO SUBSCRIBERS.

On and after July 4th this paper will give two free insertions under this heading to those in want of positions. The advertisement to occupy a space of not more than five lines. Additional space or insertions must be paid for in advance at regular rates.

Wanted—Bright, active machinists to canvass for subscription to AMERICAN MACHINIST, liberal commission. Address, with refs., Subscription Dep't, AMERICAN MACHINIST, 203 Broadway, N. Y.

Pos. as foreman; large shop pref'd. Phil., A. M.

Draftsman, young man, wants pos.; last employed in designing pumps. BOX 120, AMER. MACHINIST.

Wanted—3 good gen'l machinists for engine works in Western Pennsylvania. BOX 117, AM. MACH.

Wanted—Situation as foreman or superintendent of machine shop; best of refs. C., AM. MACH.

Wanted—Mech. engineers and draftsmen, North and West, with evenings free; state pres. position. Edwin Guthrie, Corcoran Bldg., Washington, D. C.

First-class mechanical draftsman wants to change position. R., care of AMERICAN MACHINIST.

Wanted—Six first-class, all round machinists; also two good machinery molders. Gifford Bros., Hudson, N. Y.

Wanted—A draftsman on Corliss engine work; must be a specialist and capable of leading the work. Sparrow's Point, Md., Maryland Steel Co.

Wanted—Situation as superintendent of brass works; long experience in all departments. Box 113, AMERICAN MACHINIST.

Mechanical engineer wants position: A1 designer on marine, Corliss engines, boilers, bridges; take position as draftsman. Raabe, care AM. MACH.

Good services at good pay as responsible designer, manager or assistant can be secured by addressing BOX 116, AMERICAN MACHINIST.

Young man, tech. education, wants practical exp. in eng'g. steam or electricity; salary no object. American Machinist, 206 La Salle street, Chicago.

(*Continued on Page 773.*)

BUFFALO DRILLS. FOR BLACKSMITH, CARRIAGE & WAGON MANFRS. 24 SIZES. BUFFALO FORGE BUFFALO, N.Y. U.S.A.

BUFFALO FORGES. AMERICAS BEST. THE WORLD'S STANDARD. BUFFALO FORGE BUFFALO, N.Y. U.S.A.

Crescent Steel Co.

STEEL of remarkable purity and strength for costly tools and dies.

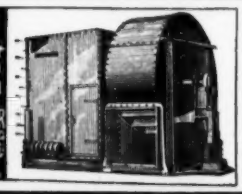
PITTSBURGH, PA.
CHICAGO, ILL.
NEW YORK, N. Y.

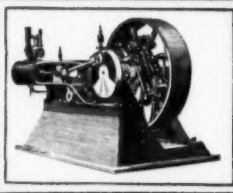
NO BETTER MADE ANYWHERE.

The fact that 140 railroads are now using our reducing valves for heating their passenger cars, ought to be a sufficient guarantee for the goods made by

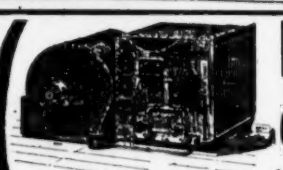
THE MASON REGULATOR CO., Boston, Mass.

THE STURTEVANT PATENT HOT BLAST STEAM HEATING APPARATUS COMBINES STEAM AND HEATER FOR VENTILATING AND DRYING B.F. STURTEVANT CO. BOSTON, MASS.





THE STURTEVANT AUTOMATIC STEAM ENGINES HORIZONTAL & UPRIGHT. SEND FOR CATALOGUES TO B.F. STURTEVANT CO. BOSTON, MASS. NEW YORK, PHILA, CHICAGO, LONDON.



HOT BLAST APPARATUS VENTILATING, DRYING, HEATING. GARDEN CITY FAN CO. MANUFACTURERS OF EXHAUST FANS, PRESSURE BLOWERS, ETC. CHICAGO, ILL. U.S.A. SEND FOR CATALOGUE E.

BORING AND TURNING MILLS

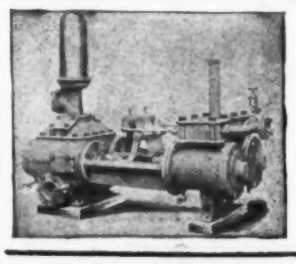
ARE SUPERIOR TO LATHES FOR FACE PLATE WORK.

We have a variety of sizes and a large stock for immediate shipment.

THE BULLARD MACHINE TOOL CO.,

E. P. BULLARD, Pres't. BRIDGEPORT, CONN.

New York Office, 86 LIBERTY STREET.



THE DEANE (OF HOLYOKE) VACUUM PUMPS,

DRY OR WET SYSTEM.

THE DEANE STEAM PUMP CO.,

HOLYOKE, MASS.

Send for "THE DEANE SPECIALTIES."

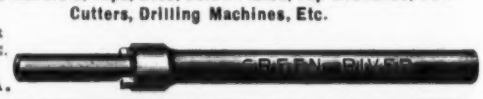
SHELL AND SOLID REAMERS,

WITH PAT. SPIRAL FLUTES.

Arbors, Mandrels, Taps, Dies, Screw Plates, Tap Wrenches, Bolt Cutters, Drilling Machines, Etc.

Wiley & Russell Mfg. Co., SEND FOR CATALOGUE.

GREENFIELD, MASS., U. S. A.



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Ready Made Iron Gears.
Ready Made Brass Gears.
Gears Made to Order.
Gear Cutting.
1895 Gear Book, Free.
Treatise on Gears, $1.00.
GEORGE B. GRANT,
Lexington, Mass.,
and 125 South 11th St.,
Philadelphia, Pa.,
and 86 Seneca St.,
Cleveland Ohio.

Star Foot-power Screw Cutting Lathes Automatic Cross Feed

9 and 12 inch Swing.

New Designs. Novel Features.

Send for Catalogue B.

SENECA FALLS MFG. COMPANY
687 Water St., Seneca Falls, N. Y.

THE GAS ENGINE

By DUGALD CLERK.

12mo. Cloth $2.00

JOHN WILEY & SONS, New York City.

"R. MUSHET'S SPECIAL STEEL"

SAVES LABOR in being able to run at GREATLY INCREASED SPEEDS. FEWER GRINDINGS. No WASTE in redressing.

SOLE REPRESENTATIVES IN THE UNITED STATES.

B. M. JONES & CO.,

BOSTON: 11 & 13 Oliver St., NEW YORK: 143 Liberty St.

CATALOGUE FREE.

LATHES! PLANERS!! SHAPERS, &c.!!!

Our tools are all of the latest and most approved designs, while the workmanship, material and finish are of the highest order. You will find it an advantage to have our catalogue and special prices before placing your order.

SEBASTIAN LATHE CO.,

117 and 119 CULVERT ST., CINCINNATI, OHIO.

ASBESTOS CEMENT FELTING,

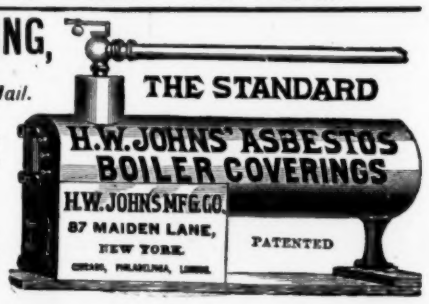
FOR LAGGING LOCOMOTIVE BOILERS.

Samples and Descriptive Price List Free by Mail.

We are prepared to take Contracts for applying Steam Pipe and Boiler Coverings in any part of the United States.

H. W. JOHNS MANUFACTURING CO.

87 Maiden Lane, NEW YORK.



Wanted—Position by good practical mechanical draftsman experienced in machine tools, cranes, elevating and general mach'y. BOX 112, AM. MACH.

Wanted—A first-class patternmaker, one familiar with heavy saw-mill, woodworking and general machinery; state age, experience and salary expected. BOX 101, AMERICAN MACHINIST.

Wanted—Sit. in N. Y. or Brooklyn as assist. supt. or draftsman; thor. knowledge of mach. construction & design; also exp'd patternmaker & machinist; 12 yrs. exp.; terms mod. BOX 111, AM. MACH.

Wanted—Position by toolmaker, who thoroughly understands die, tap, forming and experimental tool work, and who can give the best of references. Address L., care of AMERICAN MACHINIST.

Wanted—A first-class designer and patternmaker, also A1 machinist as foreman of shop doing light fine work west of the Mississippi. Address M. B., care of AMERICAN MACHINIST.

Foreman die-sinker and drop-forger would like to change about October 1st; 15 years' experience; 38 years of age; foreman the past 9 years. Box 119, AMERICAN MACHINIST.

Machine draftsman open to engagement October 1st; A1 references; varied experience as designer of tools and light automatic machinery; shop exp. and tech. education. J. G., AMERICAN MACHINIST.

Draftsman machinist or accountant competent to manage small paying plant, can have an interest and position on favorable terms; must have some cash or collateral. Address Sparta, AMERICAN MACHINIST.

Competent machinist (33), 10 years' experience on jobbing and repair work, with good executive ability, wants a situation in small shop or to take charge of repair work in manufacturing concern. Address W. J., AMERICAN MACHINIST.

Young man (21), three years in one of best technical schools, wants position, either drafting or other work, with some reliable firm; good references; anxious to get a start; wages not object. Knight, AMERICAN MACHINIST.

Wanted—Situation as foreman of machine shop; am a good machinist and draftsman and at present hold position of general foreman; first-class references furnished as to ability and character. Box 114, AMERICAN MACHINIST.

Wanted—Foremanship by a competent iron molder, who understands his business and can manage and hold his men and get work out cheaply; modern methods; best of references; age 36, and married. Address M. C., AMERICAN MACHINIST.

Blacksmith wants position as foreman; one accustomed to heavy and difficult forgings; 24 years' experience at tempering all classes of tools; age 45; best of reference. Address H. C., care AMERICAN MACHINIST.

Machinist thoroughly conversant with modern practice and requirements, with good executive ability, seeks a situation by this means on any class of work; would like to change on or before October 1st. Postal address John T. Usher, 498 Third Avenue, N. Y. City.

Wanted—A reliable mechanic of good address, possessing a thorough knowledge of steam engines and steam appliances, to travel in interest of same; must be willing to start on moderate salary. Address in own handwriting. "Salesman," care AMERICAN MACHINIST.

Wanted—A mechanical engineer of long experience filling at present a prominent position, wishes to make a change; his specialty being the inventing of improvements in steam engine and boilers; is able to take charge of drawing department; full information as to ability can be given. Box 115, AMERICAN MACHINIST.

✣ MISCELLANEOUS WANTS ✣

Advertisements will be inserted under this head at 35 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Cheap 2d hd lathes & planers. S.M.York, Clev'd, O.

Calipers & Gauges. F. A. Welles, Milwaukee, Wis.

Light and fine mach'y to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

For Sale—A first-class key-seater, new. Address Mitts & Merrill, 913 Tilden St., Saginaw, Mich.

Best and cheapest Bolt Header made by C. H. Baush & Sons, Holyoke, Mass.

Wanted—A purchaser for a good key-seater, by Mitts & Merrill, 913 Tilden Street, Saginaw, Mich.

For sale—Design and drawings of "vertical shaper;" also full details of 24"x24"x6 ft. planer; special features. Box 118, AMERICAN MACHINIST.

Pat's obt'd; no atty's fee until allowed; exp't service. Thurman & Silvius, mech. engs., Ind'polis, Ind.

Wanted—Machinery to build: special, steam, mill, hydraulic. F.C. & A. E. Rowland, New Haven, Conn.

Wanted—To correspond with any one in need of a first-class key-seater. Address Mitts & Merrill, No. 913 Tilden Street, Saginaw, Mich.

For Sale Cheap—100,000-pound Riehle testing machine, in good order. Address Alfred Box & Co., Front and Poplar streets, Philadelphia, Pa.

Any manufacturer of machine tools or special machinery desiring direct representation in New York City can learn something to his advantage by addressing Box 106, care of AMERICAN MACHINIST.

For Sale—Tabor duplex automatic molding machine with 18-inch cylinder; molds two flasks 12x15, or one flask 15x24 inches; perfect condition. Box 94, AMERICAN MACHINIST.

For sale—Second-hand tools as follows: One 24x24x5-foot planer, and one 15-inch by 5-foot engine lathe. Traverse City Iron Works, Traverse City, Mich.

For sale—Two 22" Plain Hamilton Drill Presses, one 26" back gear and power feed Hamilton Drill Press, one 30" Springfield Tool Grinder. These are new machines and will be sold cheap for cash. Dietz, Schumacher & Co., Cincinnati, Ohio.

For Sale—A foundry and machine shop together, with steam engine and boiler, also shafting in the same; plant is located 30 miles from Chicago on the Outer Belt Line which connects with all railroads entering Chicago. Address J. P., AMERICAN MACHINIST.

Wanted—An Idea. Who can think of some simple thing to patent? Protect your ideas; they may bring you wealth. Write John Wedderburn & Co., Patent Attorneys, Washington, D. C., for their $1,800 prize offer.

Wanted—An up-to-date second-hand tapping machine, for tapping cast-iron pipe fittings ¼-inch to 2 inches, or larger; also a good second-hand pipe machine, to cut and thread wrought-iron pipe 4 inches to 10 inches. T. McAvity & Sons, St. John N. B., Canada.

DON'T ACCEPT ANY SUBSTITUTE FILE.
INSIST ON HAVING
NICHOLSON

NICHOLSON FILE CO.
PROVIDENCE, R. I., U. S. A.

3000
VARIETIES FILES
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THE BERLIN IRON BRIDGE CO.
Office and Works,
No. 8 Railroad Ave., East Berlin, Conn.
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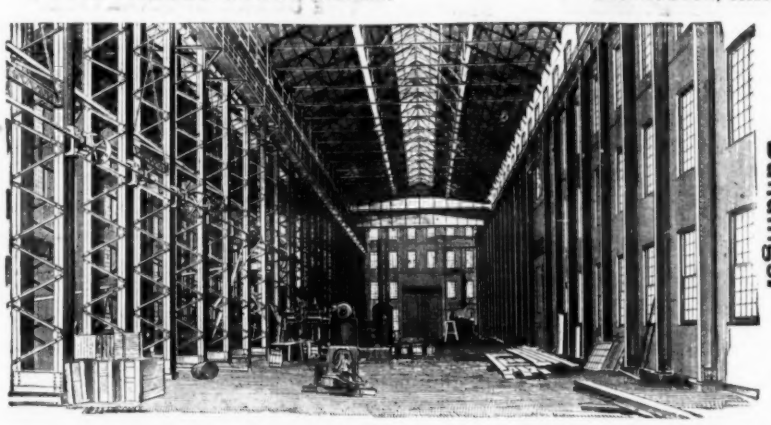
FRANK L. WILCOX, Treasurer. GEO. H. SAGE, Secretary.

Engineers, Architects and Builders of



Iron and Steel Bridges and Buildings.

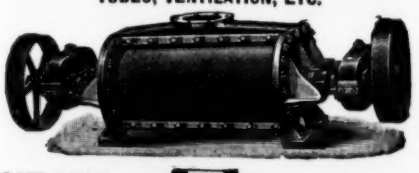
The above material taken direct from a photograph, shows the interior of a Boiler Shop designed and built by us for the Newport News Ship Building and Dry Dock Co., at Newport News, Va. The building is 100 feet in width by 300 feet in length, the width being divided into two parts of 50 feet each, with a row of columns through the center. The entire framework of the building is of iron, with light brick walls around the outside, placed between the iron posts. Hydraulic traveling cranes control the entire floor surface. The building is made very high so as to allow of boilers being removed one over another from one part of the building to the other.

SEND FOR OUR ILLUSTRATED CATALOGUE.

SOFT CASTINGS,
Made from best grades of Pig Iron for Light Machinery, Electric Work, etc.
THE BURR & HOUSTON CO.,
33 TO 39 FRANKLIN ST., BROOKLYN, N. Y.

can be of use to you
TELEPHONES SENT ON TRIAL
UNIVERSAL TELEPHONE CO.
INDIANAPOLIS, IND.

ROOT'S FORCE BLAST ROTARY BLOWER.
For FOUNDRIES, SMITH SHOPS, PNEUMATIC TUBES, VENTILATION, ETC.



SLOW SPEED, POSITIVE BLAST, PERFECTLY BALANCED.

BEST MECHANICAL CONSTRUCTION.
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Chicago Office: 1405-10 Manhattan Building.
COOKE & CO., Selling Agents,
163 & 165 Washington St., NEW YORK.
In Writing Please Mention This Paper.

HENRY CAREY BAIRD & CO.,
INDUSTRIAL PUBLISHERS, BOOKSELLERS AND IMPORTERS,
810 Walnut St., Philadelphia.
Our New and Revised Catalogue of Practical and Scientific Books, 88 pages, 8vo., and our other Catalogues and Circulars, the whole covering every branch of Science applied to the Arts, sent free and free of postage to any one in any part of the world who will furnish his address.

THE NEW FOX
Universal Trimmer
is the only one that has an accurate adjustment of the gauges. Cannot be set wrong. Work must be correct. Time saved in Pattern-making and all wood-working.
CATALOGUE FREE!
FOX MACHINE CO.,
325 Nor. Front St., Grand Rapids, Mich.
133 Finsbury Pavement, London, England.

REDUCED PRICES OF LeCOUNT'S STRAIGHT TAIL DOG.

Goods are for sale by CHAS. CHURCHILL & CO., L't'd. 21 Cross St., London, England.

To be driven from a Stud in the Face Plate.

No.	INCH.	PRICE.	No.	INCH.	PRICE.
1	¾	$0.60	10	2¾	$1.85
2	⅞	.70	11	2½	1.45
3	1	.70	12	3	1.60
4	1⅛	.80	13	3½	1.80
5	1¼	.80	14	4	2.10
6	1⅜	.95	15	4½	2.75
7	1½	.95	16	5	3.25
8	1¾	1.10	17	5½	4.00
9	2	1.20	18	6	5.00
1 Set to 2 in.		7.80	Full Set.		$1.10

C. W. LeCOUNT, South Norwalk, Conn.

STEEL CASTINGS OF EVERY DESCRIPTION.
MADE FROM BEST
OPEN HEARTH STEEL.
Send for Estimates.
THE JOHNSON COMPANY, Johnstown, Pa.

NOW READY!
Modern Examinations of Steam Engineers.
WRITTEN FOR ENGINEERS BY AN ENGINEER.
12mo. Cloth. 300 Pages. 53 Chapters.
Comprising full and complete answers to 300 questions for the use of engineers and firemen, when preparing to make application for examination for U. S. government and State license; and for the information of engine builders, boiler makers, machinists, etc.
By W. H. WAKEMAN.
PRICE, - - - $2.00
AMERICAN INDUSTRIAL PUB. CO., Bridgeport, Conn.

Massachusetts Emery & Corundum Wheels
These wheels are made from the purest of Emery and Corundum only; they are made by a process that does not injure the particles, but allows them to retain all their natural hardness and sharpness.
MASSACHUSETTS CORUNDUM WHEEL CO.,
MANUFACTURERS OF
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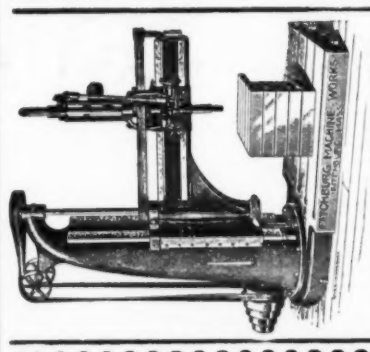

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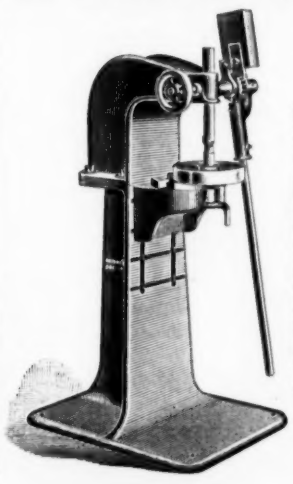

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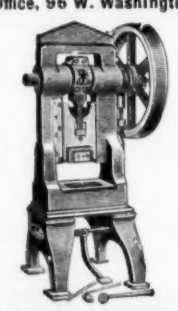

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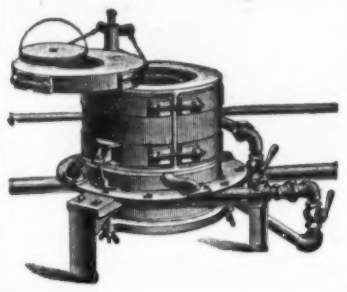

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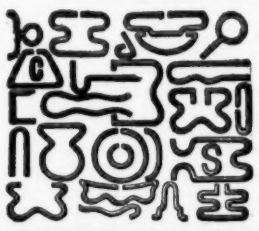

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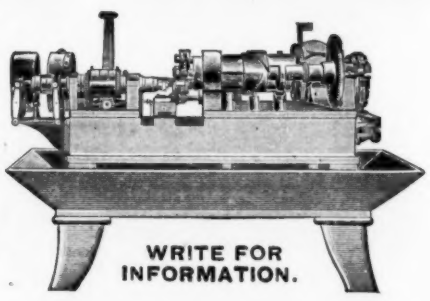

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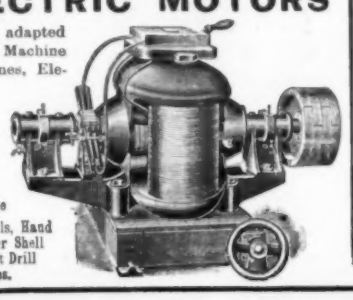

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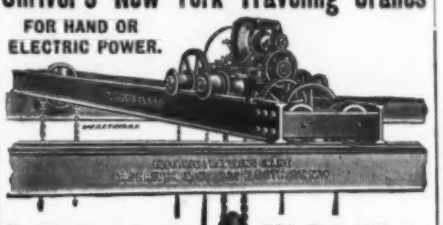

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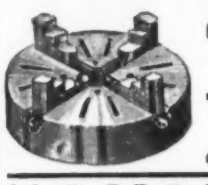

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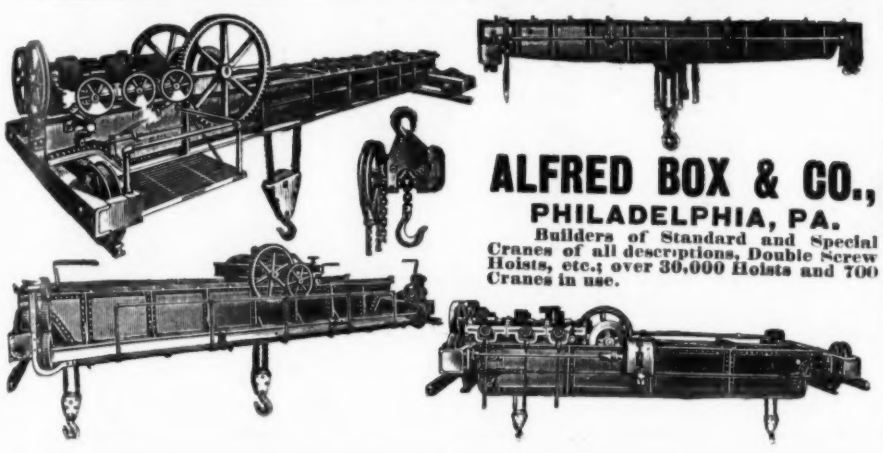

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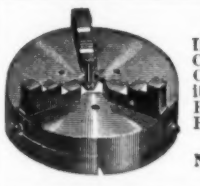

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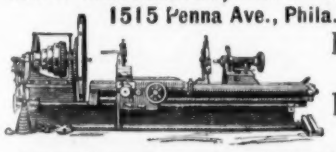

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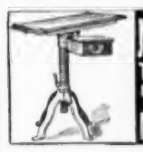

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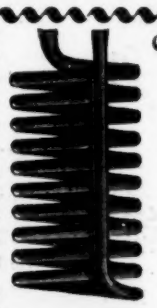

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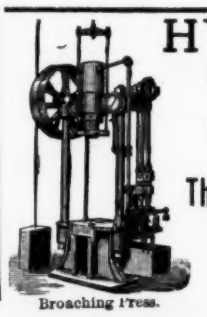
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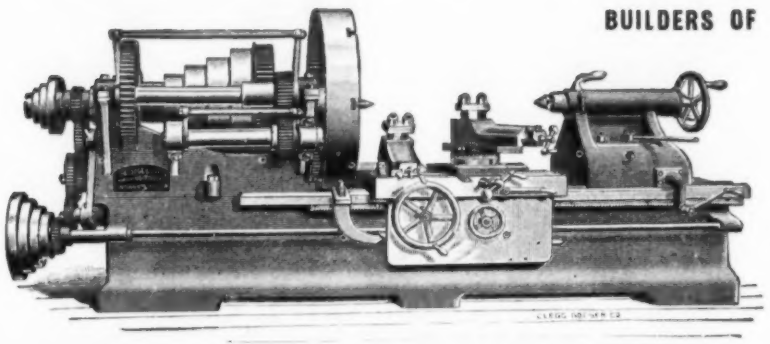

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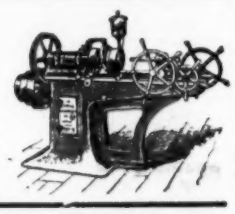

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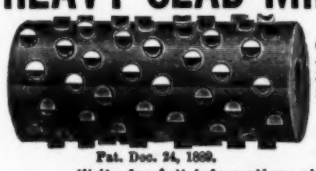

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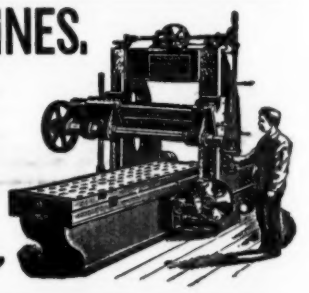

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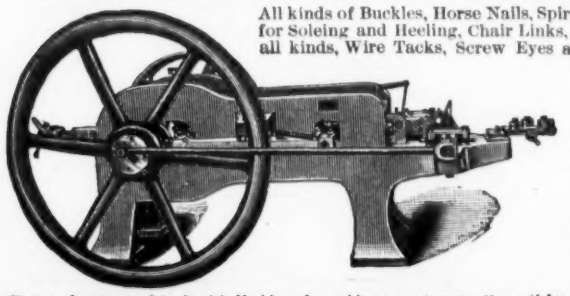

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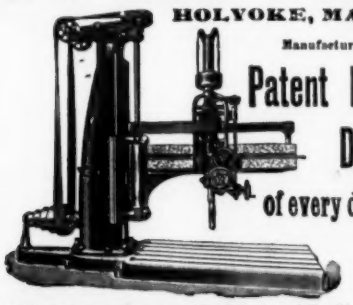

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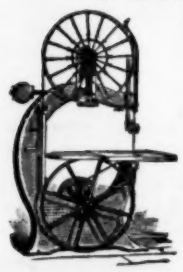

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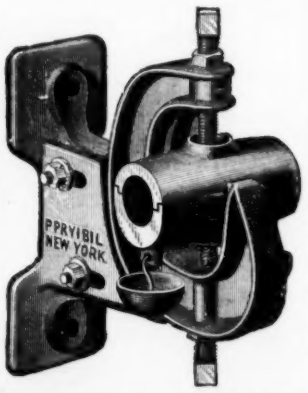

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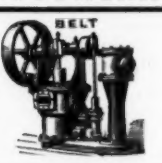

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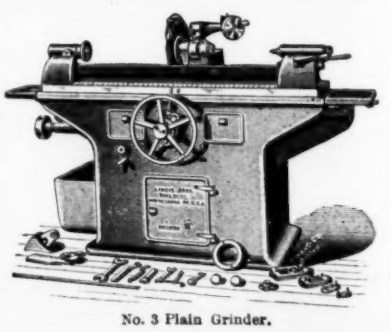

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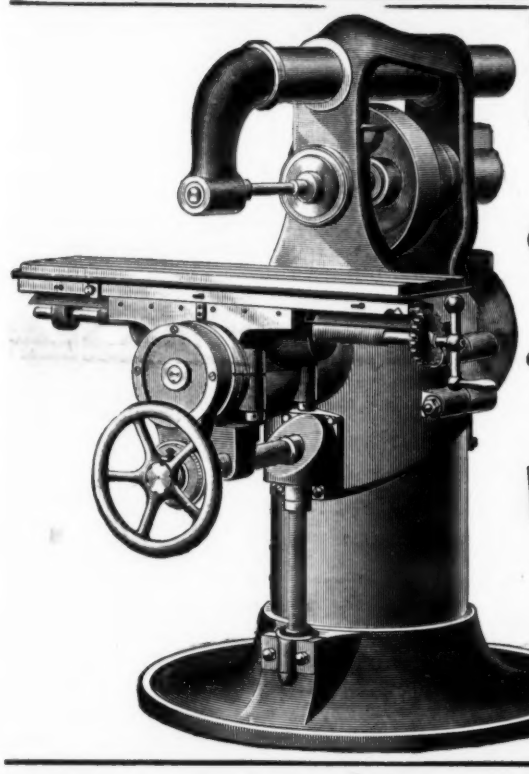

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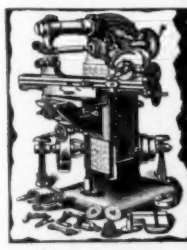

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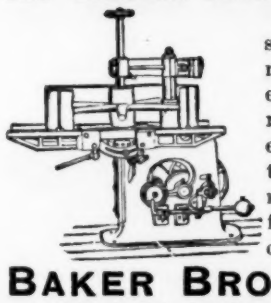

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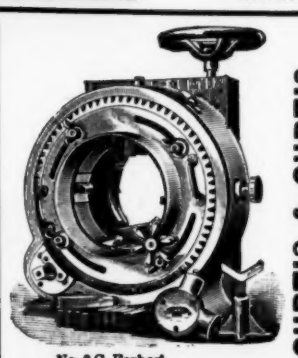

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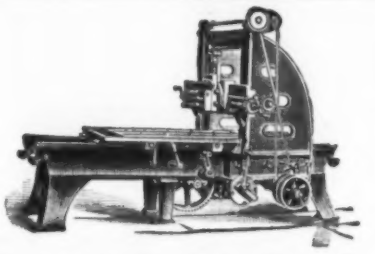

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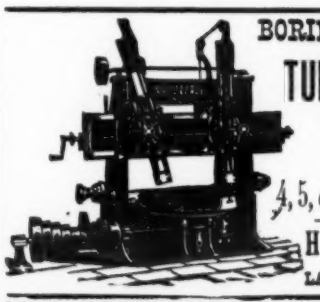

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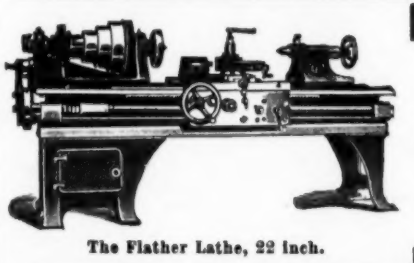

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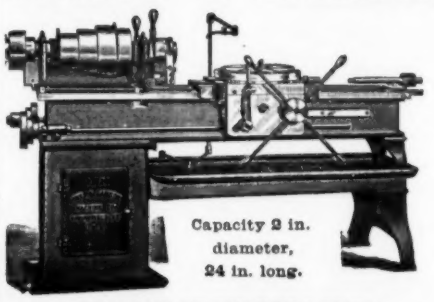

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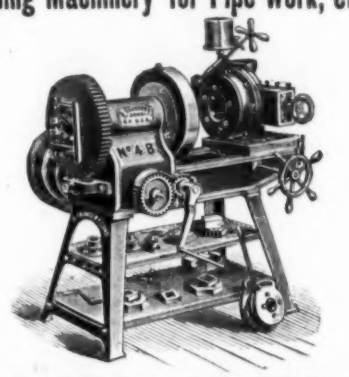

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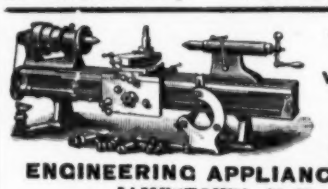

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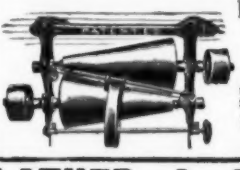

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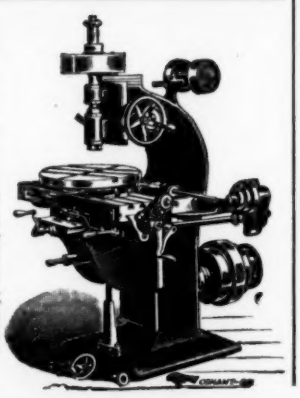

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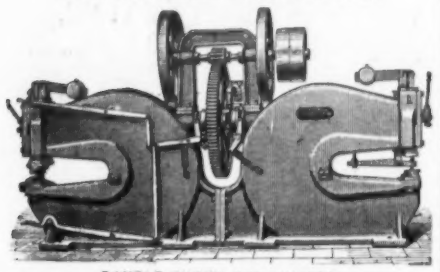

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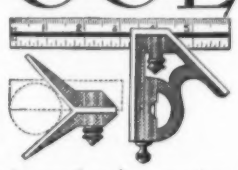

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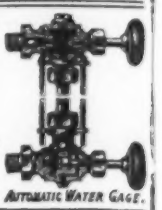

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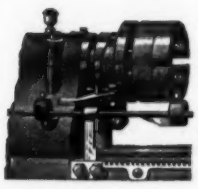

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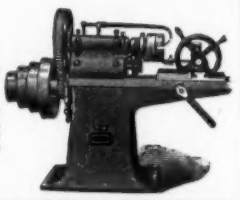

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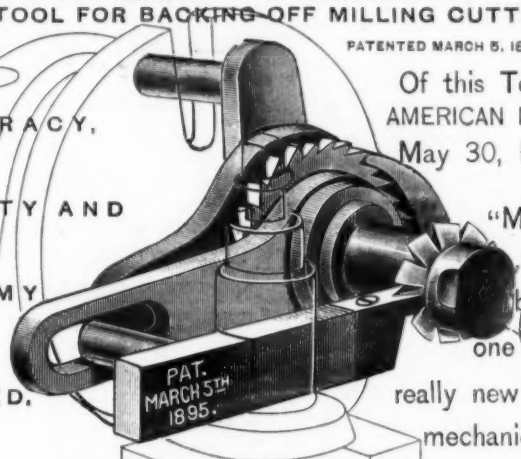

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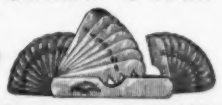

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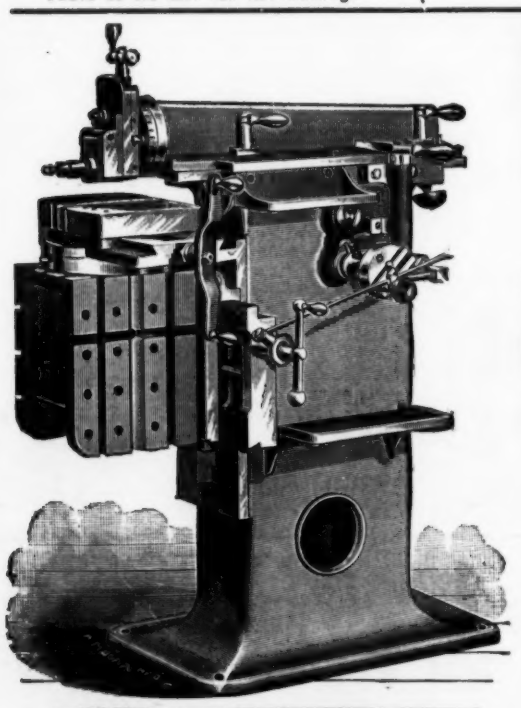

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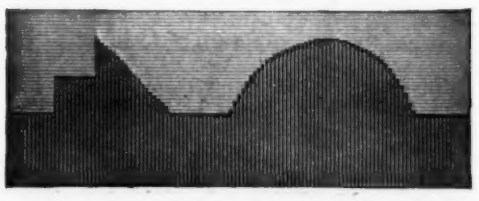

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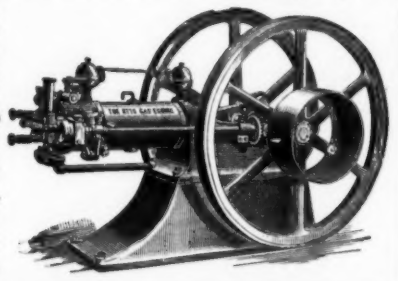

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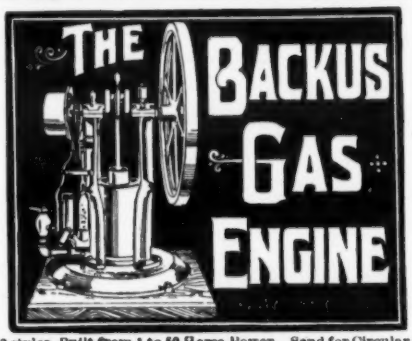

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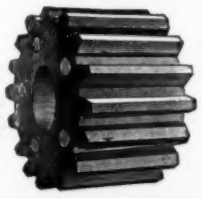

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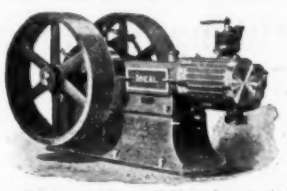

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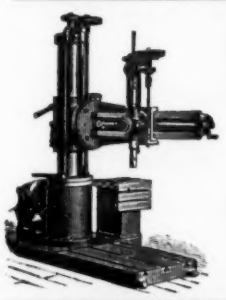

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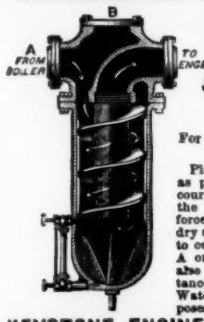

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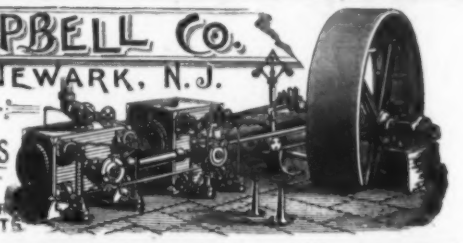

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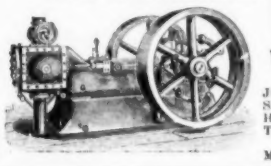

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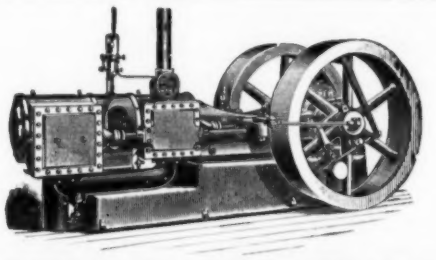

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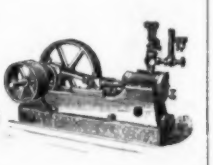

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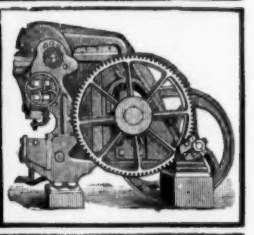

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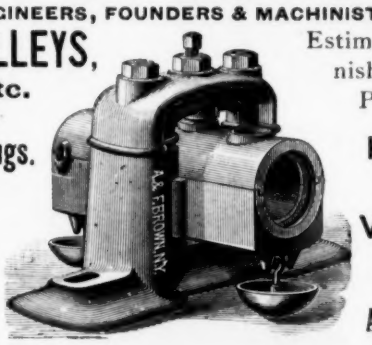

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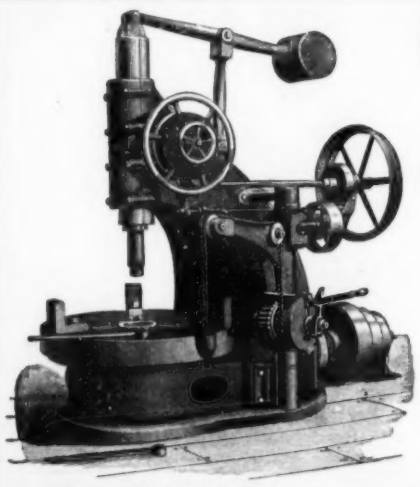

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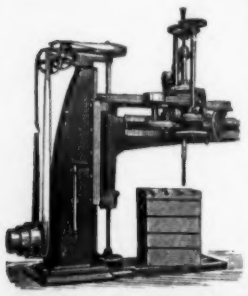

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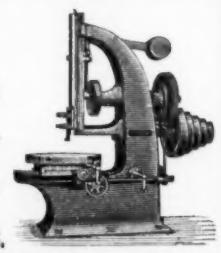

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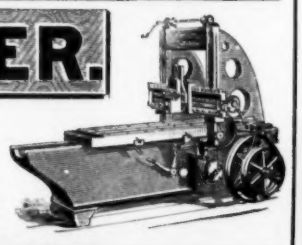

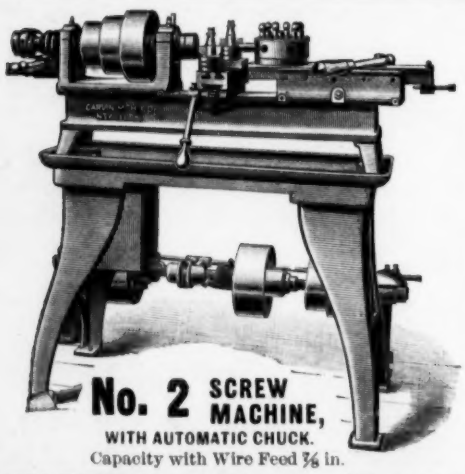

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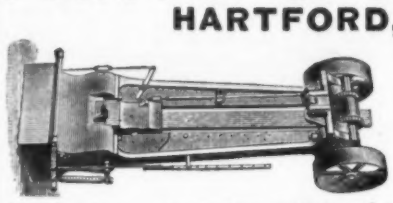

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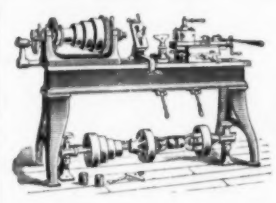

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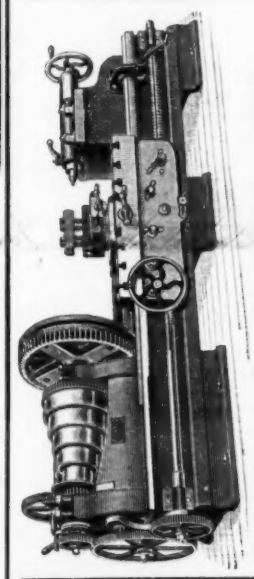

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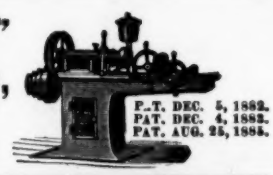

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